RECORD OF DECISION

CHEMICAL RECOVERY SYSTEMS

ELYRIA, LORAIN COUNTY, OHIO

PREPARED BY:

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 5
CHICAGO, ILLINOIS

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ACRONYMS AND ABBREVIATIONS

ABS	Absorption Fraction
ASTM	American Society for Testing and Materials
AST	Aboveground Storage Tanks
ATSDR	Agency for Toxic Substances and Disease Registry
ARARS	Applicable or Relevant and Appropriate Requirements
AWQC	National Ambient Water Quality Criteria
Bgs	Below ground surface
BRA	Baseline Risk Assessment
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
^0C	Degrees Celsius
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CGI	Combustible Gas Indicator
CHED	City of Elyria Health Department
COPEC	Chemicals of Potential Ecological Concern
COPC	Chemicals of Potential Concern
CRQL	Contract-Required Quanitation Limit
CSM	Conceptual Site Model
CRS Site	Chemical Recovery Systems
CSO	Combined Sewer Outfall
CWA	Clean Water Act
DO	Dissolved Oxygen
DOI	Department of Interior
ESL	Ecological Screening Level
EOLP	Erie Ontario Lake Plain
EPC	Exposure Point Concentration
EPT	Ephemeroptera, Plecoptera, and Trichoptera
ERA	Ecological Risk Assessment
E-RAG	Ecological Risk Assessment Guidance
eV	Electron Volt
FID	Flame Ionization Detector
FIT	Field Investigation Team
FS	Feasibility Study
FSP	Field Sampling Plan
GAF	Gastrointestinal Absorption Factor
gpm	Gallons per Minute
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HI	Hazardous Index
HQ	Hazardous Quotient
IEUBK	Integrated Exposure Uptake Biokinetic
ILCR	Integrated Lifetime Cancer Risk
IRIS	Integrated Risk Information System
K_{oc}	Organic Partition Coefficient

K_{ow}	Octanol/Water Partition Coefficient
K_p	Permeability Coefficient Lowest Observe A
LEL	Lower Explosive Limit
MCLs	Maximum Contaminant Levels (as regulated under the Safe Drinking Water Act)
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
mL	Milliliter
ml/min	Milliliter per Minute
LOAEL	Lowest Observed Adverse Effect Level
MSL	Mean Sea Level
NEDO	North East District Office
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NCP	National Contingency Plan
NFG	National Functional Guidelines
ng	Nanograms
NOAA	National Oceanic Atmospheric Administration
NOAEL	No Observed Adverse Effect Level
NPL	National Priorities List
NTU	Nephelometric Turbidity Unit
ORP	Oxidation/Reduction Potential
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PEF	Particulate Emission Factor
PID	Photoionization Detector
ppm	Parts per Million
PRG	Preliminary Remediation Goal
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QHEI	Qualitative Habitat Evaluation Index
RAGS	Risk Assessment Guidance for Superfund
RAOs	Remedial Action Objectives
RAS	Routine Analytical Services
RBSL	Risk-Based Screening Level
RCRA	Resource Conservation Recovery Act
RD	Remedial Design
RDA	Recommended Daily Allowance
RfD	Reference Dose
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RPD	Relative Percent Difference
RSDs	Risk-specific Doses

SARA	Superfund Amendments and Reauthorization Act
SEC	Specific electrical conductance
SFW	Water Skin Contact Factor
SLERA	Screening Level Ecological Risk Assessment
SOW	Statement of Work
SQL	Sample Quanitation Limit
SRA	Supplemental Risk Assessment
SSL	Soil Screening Level
SVOC	Semi volatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TEC	Threshold Effects Concentration
TEF	Toxicity Equivalent Factor
TOC	Total Organic Carbon
TSS	Total Suspended Solids
µg/kg	Micrograms per Kilogram
µg/l	Micrograms per Liter
USGS	United States Geological Survey
VOC	Volatile Organic Compound
WWTP	Wastewater Treatment Plant

PART 1 THE DECLARATION

1.1 Site Name and Location

This Record of Decision (ROD) is for the Chemical Recovery Systems (CRS Site) located at 142 Locust Street, City of Elyria, Lorain County, Ohio 44305; Site Identification Number OHD 057001810.

1.2 Statement of Basis and Purpose

This decision document presents the Selected Remedy for the Chemical Recovery Systems, Inc. Superfund Site ("CRS Site"), which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The decision is based on the Administrative Record for the CRS Site. The State of Ohio concurs with the Selected Remedy.

1.3 Assessment of Site

The response action selected in this Record of Decision is necessary to protect the public health or welfare and the environment from actual or threatened releases of hazardous substances to the environment.

1.4 Description of Selected Remedy

The overall cleanup strategy for the CRS Site is to reduce the amount of contamination in soil, sediment, and groundwater to protect both human and ecological receptors from exposure to the following CRS Site-specific chemicals of concern (COCs): 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichloroethane, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260, arsenic, benzene, cis-1,2-dichloroethene, ethylbenzene, methylene chloride, dibromochloromethane, naphthalene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chloroethane, chloroform, dibenzo(a,h)anthracene, indeno(1,2,3-c,d)pyrene, manganese, tetrachloroethene, toluene, trans-1,2-dichloroethene, trans-1,3-dichloropropene, trichloroethene, vinyl chloride and xylenes.

The selected remedy removes source materials constituting principal threats at the CRS Site. To eliminate the data gap identified post RI/FS, additional monitoring wells will be placed on-site during the pre-design phase of the project. The purpose is to further identify the lateral groundwater plume and to investigate fully the potential vapor intrusion pathway threat to residential receptors across the river. The major components for the Selected Remedy include:

- Air monitoring during construction;
- Excavation and off-site disposal, at a permitted facility, of approximately 4 feet (3,500 cubic yards) of contaminated soil in the area of high soil contamination in the NW corner of the CRS Site. The lateral extent of the excavation will be determined during pre-design;
- Soil Sampling Verification;
- Backfill excavated area with clean fill;
- Closure of two on-site sump pumps;
- Demolish two on-site structures,
- Repair sewer line;
- 2 feet of clean soil over the 2.5-acres
- Monitored Natural Attenuation of Groundwater;

- Institutional controls;
- Fence; and
- 30-yr O&M

The Selected Remedy Institutional Controls:

- For ground water: prohibit potable or non-potable use of groundwater until restored to Safe Drinking Water Standard for all chemicals of concern (COCs);
- For land use: restrictive covenant or some other appropriate control for the land use to be zoned as industrial/commercial use only; and
- For the soil underneath the cover system: no digging or placing structures on the cover system without notification and approval from EPA.

This remedial action objective is to restore the groundwater to safe drinking water standards by monitored natural attenuation. At the CRS Site the aquifer is not being used for any potable purposes within a one-mile radius, however once the groundwater is restored it could be used for potable purposes. Based on information obtained during the remedial investigation, and the analysis of all remedial alternatives, EPA and Ohio EPA believe that the Selected Remedy may be able to achieve this goal. The lines of evidence to support MNA will be presented in Section 2.5.6.4.1. Groundwater contamination is especially persistent in the immediate vicinity of the contaminants' source, where concentrations are relatively high. The ability to achieve the MCLs at all points throughout the area of the plume cannot be determined until the remedial action has been implemented, and the plume response to the remedial action monitored over time. The CRS Site specific monitoring and sampling plan will be developed consistent with EPA's Monitored Natural Attenuation Guidance (OSWER Directive 9200.4 – 179).

If the selected groundwater remedy does not meet the specified remediation goals within a reasonable timeframe, contingency remedy measures, at a minimum, will be invoked to prevent further migration of the plume, and include a combination of active groundwater treatment or other innovative measures if MNA is not occurring. These measures are considered to be protective of human health and the environment, and are technically practicable under the corresponding circumstances.

If, in EPA's judgment, implementation of the selected remedy clearly demonstrates that natural attenuation will not occur within a reasonable timeframe in the plume, a contingency remedy will be implemented. A contingency remedy may be invoked when it has been demonstrated that contaminant levels have ceased to decline over time, and have remained constant for a specified period of time at some statistically significant level above remediation goals, as verified by multiple sampling events. The following suggested language describes the recommended contingency remedy measures:

If it is determined, on the basis of the preceding criteria and the performance data, that the aquifer cannot be restored to their beneficial use, any of the following measures, or other innovative technologies, involving long-term management may occur, for an indefinite period of time:

- Engineering controls such as physical barriers, or long-term gradient control provided by low level pumping, as containment measures;

- Chemical-specific ARARs may be waived for the cleanup of those portions of the aquifer based on the technical impracticability of achieving further contaminant reductions;

- Institutional controls may be provided/maintained to restrict access to those portions of the aquifer which remain above remediation goals;

- Continued monitoring of specified wells; and

- Periodic reevaluation of remedial technologies for groundwater restoration.

If the selected groundwater remedy does not meet the specified remediation objectives within a reasonable timeframe, active groundwater remediation measures will be implemented to prevent further migration of the plume.

The decision to invoke additional groundwater remediation measures may be made during a periodic review of the remedial action, which will occur at least every five years, in accordance with CERCLA section 121 (c).

1.5 Statutory Determinations

The Selected Remedy will protect human health and the environment, will comply with all Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action unless the invocation of a waiver of such requirements is justified, will provide overall effectiveness appropriate to its costs, and will utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. U.S. EPA also evaluated a Soil Vapor Extraction (SVE) treatment system for the "hot-spot" 0.5-acre located in the NW portion of the CRS Site. EPA determined that selection of the SVE remedy had a high potential for being inefficient and problematic at the CRS Site. Several other treatment technologies were also evaluated during the pre-screening of the alternative array. EPA determined that none of the treatment technologies evaluated would be useful at this Site for various site-specific reasons (e.g., soil types). Thus, the Selected Remedy does not satisfy the statutory preference for treatment as a principal element.

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, once the remedy is in place, EPA is required to conduct a review of the protectiveness of the remedy every five years after initiation of remedial action. During the Five Year Review, ground water monitoring data will be evaluated to determine if MNA is effectively reducing concentrations of hazardous substances in the contaminated soils. EPA, in consultation with Ohio EPA, will evaluate the appropriate options for ground water remediation if EPA decides that MNA is not working and a contingent remedy for the contaminated groundwater becomes necessary.

1.6 Data Certification Checklist

The following information is included in the Decision Summary section of this Record of Decision (Part 2). Additional information can be found in the Administrative Record file for the CRS Site.

1) Chemicals of concern and their respective concentrations.

Section 1.4, page 12, Description of Selected Remedy;

Tables 4-A & 4- B Human Health Chemicals of Concern in Soil; and Chemicals of Concern in Groundwater, page 48, and page 65, respectively. Section 2.7.2.1, page 87, Identification of Chemical of Concern (Ecological)

2) Baseline risks represented by the chemicals of concern.

Table 2 page 78, Human Health Risk Assessment Summary

3) Cleanup levels established for chemicals of concern and the basis for these levels.

Section 2.8.1, page 112, Remedial Action Objective Summary; and Table 7, page 113, CRS Site Specific Remedial Action Objectives.

4) How source materials constituting principal threats will be addressed.

Section 2.11, page 139, Principal Threat Wastes

5) Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD.

Section 2.6, page 75, Current and Potential Future Land Uses

6) Potential land and groundwater use that will be available at the CRS Site as a result of the Selected Remedy.

Section 2.6, page 75, Current and Potential Future Land Uses; and
Section 2.12.4, page 146, Expected Outcome of the Selected Remedy

7) Estimated capital, annual O&M, and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected.

Table 10, page 143, Detailed Cost Estimate of the Selected Remedy – Alternative 6.

8) Key factor(s) that led to selecting the remedy.

Section 1.2, page 12, Statement of Basis and Purpose;
Section 2.10, page 134, Comparative Analysis of Alternatives

1.7 Authorizing Signature

for R.K. 10/30/07

Richard C. Karl, Director
Superfund Division

Date

PART 2 THE DECISION SUMMARY

2.1 Site Name, Location, and Brief Description

This Record of Decision (ROD) is for the Chemical Recovery Systems Site located at 142 Locust Street, City of Elyria, Lorain County, Ohio. The CRS Site's coordinates are latitude 41 degrees, 22' 14.45" and its longitude 82 degrees, 06' 14.8 W. The United States Environmental Protection Agency's (EPA) Site Identification Number is OHD 057001810. The lead agency for this Site is the EPA. The CRS Site is a Superfund Alternative Site, and is not on the NPL.

CRS Site is approximately 2.5 acres, is bordered on the west by the East Branch Black River, to the north and east by BASF (formerly Engelhard, and Harshaw Chemical Company), and to the south by M&M Aluminum Siding Company. CRS Site is located in a 200-year old industrial and commercial area near the central business district of Elyria. CRS Site is currently leased to M&M Aluminum. M&M Aluminum uses the property for storage. Most of the 2.5-acre property is empty. Two buildings are currently on the CRS Site: a former warehouse and office building and the masonry shell of a building that housed a Rodney Hunt still. These buildings are located in the southeast corner of the CRS Site. The foundation of a building that housed a Brighten still is located in the northeast corner of the CRS Site. The CRS Site is fenced on all sides except the side bounded by the East Branch Black River. Four pipes (subsurface conduits) protrude from the river bank on the western boundary. In the NW portion of the CRS Site, the primary subsurface conduit is a Storm Sewer outfall pipe, which runs from Locust Street underneath the CRS Site and discharges to the River. A manhole on Locust Street provides access to the storm sewer, which drains surface run-off from Locust Street and BASF.

2.2 Site History and Enforcement Activities

2.2.1 Activities That Led To Current Problem

Beginning no later than the 1940s the CRS Site was used for commercial and industrial purposes such as a coal yard. In 1960, Russell Obitts, owner of Obitts Chemicals, leased the property and relocated the company business at the site. This business reclaimed "spent" organic solvents, distilled away the impurities, and sold the reclaimed solvents to businesses. Later Russell Obitts and Dorothy Obitts purchased the property.

In 1974, Chemical Recovery Systems, Inc., a Michigan corporation ("CRS, Inc"), assumed operations at the CRS Site through a stock purchase agreement with the Obitts Chemical Company. In a separate agreement CRS, Inc. leased the property from Russell and Dorothy Obitts in a lease agreement with an option to purchase. A year later CRS, Inc. exercised its purchase option. CRS, Inc. continued operations at the CRS Site until 1981.

Operating as Obitts Chemical Company and then as CRS, Inc. the facility located on the property collected spent organic solvents from various industrial facilities and reclaimed the cleaned solvents through distillation processes. Both operators hauled contaminated solvents to the CRS Site facility by their own tanker trucks and stake trucks hauling 55-gallon drums. Spent solvents were stored at the facility in above ground tanks and 55-gallon drums. Soil

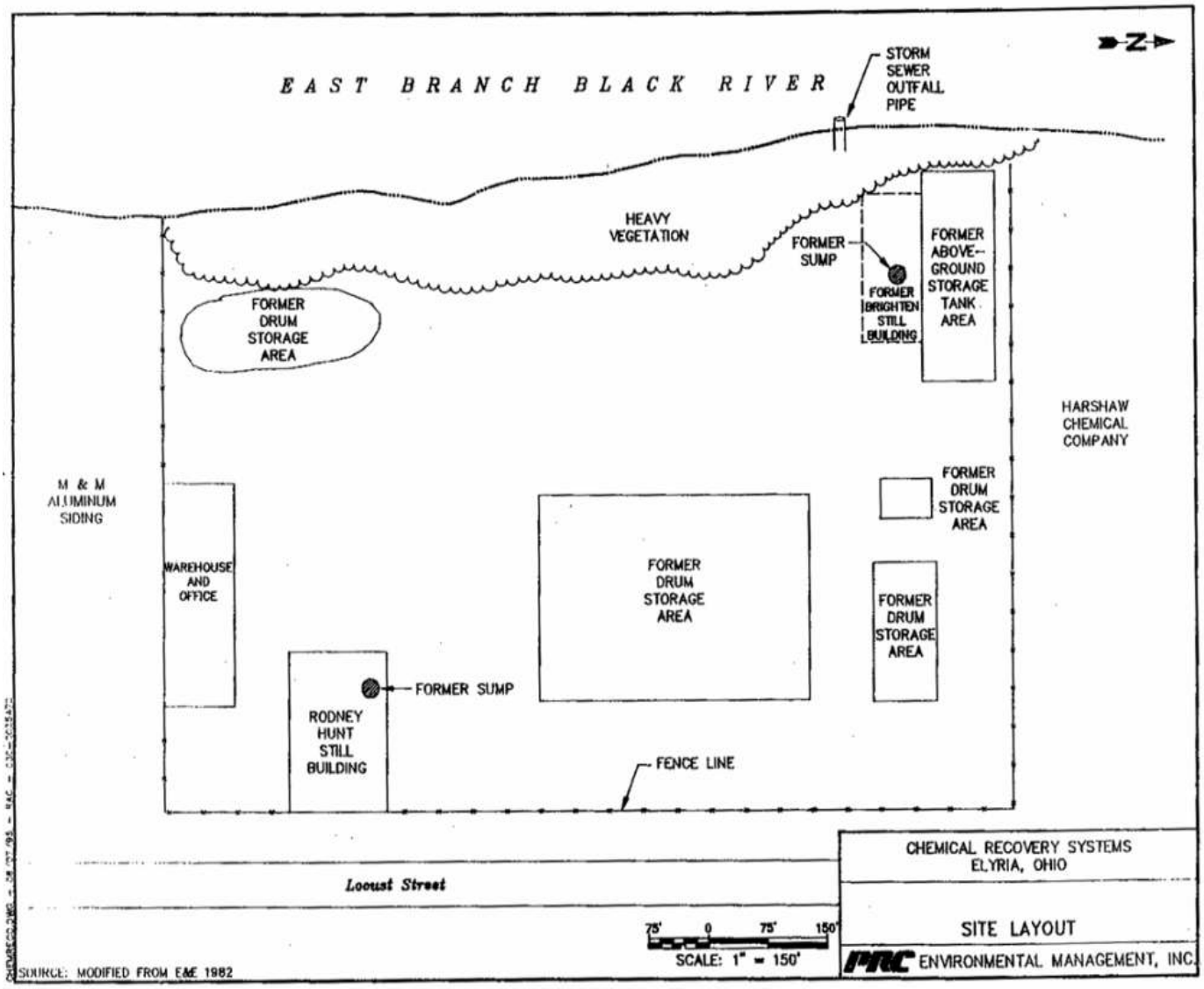
contamination occurred through leakage and spills from drums and tanks located on the CRS Site.

Spent solvents hauled to the CRS Site in tanker trucks were transferred into above ground storage tanks ("AST") located in the northwest corner of the CRS Site. The CRS Site had nine tanks with a total capacity of 53,500 gallons. These tanks were improperly grounded, vented, and constructed and violated Ohio fire codes. The 55-gallon drums were stored in four main areas of the CRS Site, three of which were located in the northern area of the CRS Site. The fourth storage area was in the southwest corner of the property. EPA, Ohio Environmental Protection Agency ("Ohio EPA"), and the City of Elyria Health Department ("CEHD") observed 4,000 to 9,000 drums of 55-gallon capacity stored on the CRS Site during an inspection (Photograph 1). Some drums were unmarked or deteriorating and leaking their contents onto the ground. The spent solvents transported to CRS include the following: acetone, hexane, isopropyl alcohol, methyl-ethyl ketone, tetrachloroethane, toluene, trichloroethane, and xylene.

The CRS Site operated two distillation units. A Rodney Hunt still was located in the southeast corner of the property and a Brighton still was housed in the northwest corner of the property (Figure 1). The facility processed approximately 250,000 gallons of "spent" solvents per month. The distillation operation generated approximately 10,000 gallons of waste sludge per week. The majority of the sludge-waste was disposed of at Robert Ross and Sons, Inc., Grafton, Ohio and the Carter Oil Company, Michigan. A sump pump was located near each still. During a site visit in the 1980s, a sample of water drawn from one sump contained polychlorinated biphenyls ("PCBs).

Photograph 1 CRS -Site In Full Operations 1980s

Figure 1 CRS Site Diagram



2.2.2 Site Operations, Previous Investigations, and CERCLA Enforcement Activities

2.2.2.1 1960 – 1974 - Obitts Chemical Company

Russell Obitts formed two chemical companies: Obitts Chemical Services and Obitts Chemical Company. Both companies reclaimed spent solvents. One company recycled solvents from rubber industries and the other company recycled solvents mostly from paint industries. After distilling the "spent" solvents, the "cleaned" reclaimed solvents were repackaged and sold. The solvents were transported to and from the facility in 55-gallon drums or by tanker trucks.

2.2.2.2 January 1, 1974 - Chemical Recovery Systems

CRS, Inc. leased the property from Mrs. Obitts, and then eventually, Chemical Recovery Systems, Inc. (CRS) assumed operation of the CRS Site through a stock purchase agreement with the Obitts Chemical Company.

2.2.2.3 1974 – 1981 - CRS Site Operations

CRS continued in the business of solvent reclamation and sales. The solvents continued to be stored in 55-gallon drums, AST, and tanker trucks.

2.2.2.4 1980 - Site Inspection

Ohio EPA's, Northeast District Office (NEDO) alleged that releases from the CRS Site were affecting the River.

2.2.2.5 1980 - Citation Filed

NEDO's concerns about the CRS Site conditions and photographs taken by the local Fire Marshal led EPA to file a lawsuit against CRS requiring the facility owners to address environmental issues at the CRS Site.

2.2.2.6 October 7, 1980 - Complaint Filed by EPA

EPA filed a complaint alleging violations of Sections 7003 of the RCRA and 301 (a) of the CWA. The two principal concerns cited in the complaint were the threat of fire and explosion posed by the presence of approximately 4,000 drums of chemical waste on the CRS Site, and the presence of defective distillation units. The complaint also alleged that a leachate stream containing PCBs was running down the bank entering into the River.

2.2.2.7 1981 - CRS Ceased Operations

In response to the lawsuit, CRS ceased receipt, storage, and processing of "spent" solvent. CRS removed all tanks, drums, and other solvent containers from the CRS Site, ceased operations and filed for bankruptcy prior to 1983.

2.2.2.8 September 1981 - EPA CERCLA Investigation

A Hydrogeological and Extent of Contamination Study Report, Ecology & Environment (E&E), Inc; (April 1982). During the investigation, four monitoring wells were installed, two upgradient, and two downgradient of the CRS Site (groundwater flow is from east to west toward the River). During this investigation, soil, groundwater, surface water, and sediments samples were collected and analyzed.

In summary, the report documented the media most impacted were soil and groundwater with volatile organic compounds (VOCs), polychlorinated biphenyls

(PCBs), semi-volatile organic compounds (SVOCs), and metals. The samples collected from the down gradient (toward the River) monitoring wells had high concentrations of VOCs and SVOCs. In all four monitoring wells, metals were detected above action levels. Sediment and surface water samples analyzed detected VOCs, SVOCs, and metals. The greatest VOC concentrations were in samples collected down gradient of the storm sewer outfall pipe located in the NW corner of the CRS Site protruding from the slope of the riverbank. All samples analyzed detected SVOCs and metal concentrations above their respective action levels.

2.2.3 Enforcement Activities

2.2.3.1 July 12, 1983, EPA Consent Decree

CRS entered into a Consent Decree to address the following five actions:

1. Excavate all visibly contaminated soil identified during a joint inspection conducted by representatives of EPA and CRS.
2. Excavate the perimeter of the Brighton Still building in the northwest corner of the CRS Site to a depth of 1 foot and a distance of 2 feet beyond the perimeter of the foundation.
3. Dispose of all removed soil at an EPA-approved disposal facility.
4. Backfill the excavated areas with clean, clay containing fill.
5. Gently grade the CRS Site towards the River.

On September 15, 1983, EPA concluded that CRS was in compliance with the Consent Decree.

2.2.3.2 August 1996, Ohio EPA Investigations

Ohio EPA conducted a Site Team Prioritization (STEP) Investigation on behalf of EPA. The STEP investigation detected contaminants in all environmental media. The five pathways evaluated during the STEP investigation were groundwater, surface water, sediments, soil, and air.

September 1997**,** Ohio EPA completed the STEP Report, which included a pre-scoring for the National Priorities List (NPL). Currently, the CRS Site is not listed on the NPL. CRS is, however, considered by EPA as an NPL-equivalent site, (now known as Superfund Alternative Sites (SAS)), and may be proposed for inclusion on the NPL under Section 105 of CERCLA, 42 U.S.C. § 9605.

2.2.3.3 July 2, 1999, Health Consultation

The Agency for Toxic Substances and Disease Registry (ATSDR) with the support of the City of Elyria Health Department completed a Health Consultation, which concluded that the CRS Site currently poses no apparent health hazard to area residents (ATSDR, July 2, 1999). ATSDR

and the Elyria Health Department also concluded that the currently detected concentrations of chemicals in the surface soils at the CRS Site pose a minimal health hazard to on-site workers.

2.2.3.4 CERCLA Enforcement Activities

October 31, 2001, EPA issued General Notices of Potential Liability and information request under Section 104(e) of CERCLA, 42 U.S.C. § 9604(e)(2), to Respondents.

2.2.3.4.1 May 29, 2002, AOC signed for RI/FS.

EPA's Superfund Director signed an Administrative Order on Consent with 23 Respondents to perform a Remedial Investigation/Feasibility Study (RI/FS).

2.2.3.4.2 September 30, 2003**,** *DeMinimis* AOC signed.

EPA's Superfund Director signed an Administrative Order on Consent with 83 *De Minimis* Contributors.

2.3 Community Participation

Two Availability Sessions were held and Community Interviews were conducted during 2002. A Fact Sheet was mailed to the community during July 2003 announcing the beginning of the RI/FS.

The Proposed Plan Fact Sheet was mailed to the community on July 9, 2007. The Administrative Record file was made available to the public on July 23. 2007. It was placed in the information repository maintained at the EPA Region 5 Superfund Record Center and the Elyria Public Library. The notice of the availability of the Administrative Record and an announcement of the Proposed Plan public meeting was published in the Lorain Morning Journal on July 11, 2007. A public comment period was held from July 16, 2007 to August 14, 2007. The Proposed Plan public meeting was presented to the community in a public meeting on July 26, 2007 at the City Council Chambers. At this meeting, EPA answered questions about the CRS Site conditions and the remedial alternatives proposed for the CRS Site. During the public meeting a request for an extension to the comment period was made. The request was for an additional 30-days, as provided by the NCP. A newspaper advertisement was published in the Elyria Chronicle on August 16, 2007, announcing the extension of the public comment period to September 13, 2007.

2.4 Scope and Role of Operable Unit or Response Action

EPA has chosen to use only one Operable Unit for the CRS Site. The Selected Remedy will address the highly contaminated soil located in the northwest corner of the CRS Site (0.5-acres), via excavation, backfill, and off-site disposal. A two-foot soil cover will be placed over the entire CRS Site to eliminate direct contact to the residual VOCs and metal contaminants found in the soil. The off-site disposal methods for the excavated material will vary depending on the characterization of the contaminated material. This action will also reduce the risk to human health and the environment to an acceptable risk level and also reduce further

contamination to the groundwater and the river. Ingestion of water extracted from this aquifer poses a potential future risk to human health because EPA's acceptable risk range has been exceeded and concentrations of contaminants are greater than the maximum contaminant levels for drinking water (as specified in the Safe Drinking Water Act). This remedy will utilize institutional controls in the form of restrictive covenants, or other appropriate controls on the property to prohibit:

- Compromise to the CRS Site cover system;
- Groundwater use for potable and non-potable purposes, until restoration to Safe Drinking Water Standards are attained for all contaminants of concern;
- Zoning other than industrial/commercial only; and
- Building structures on the CRS Site without EPA notification and approval.

2.5 Site Characteristics

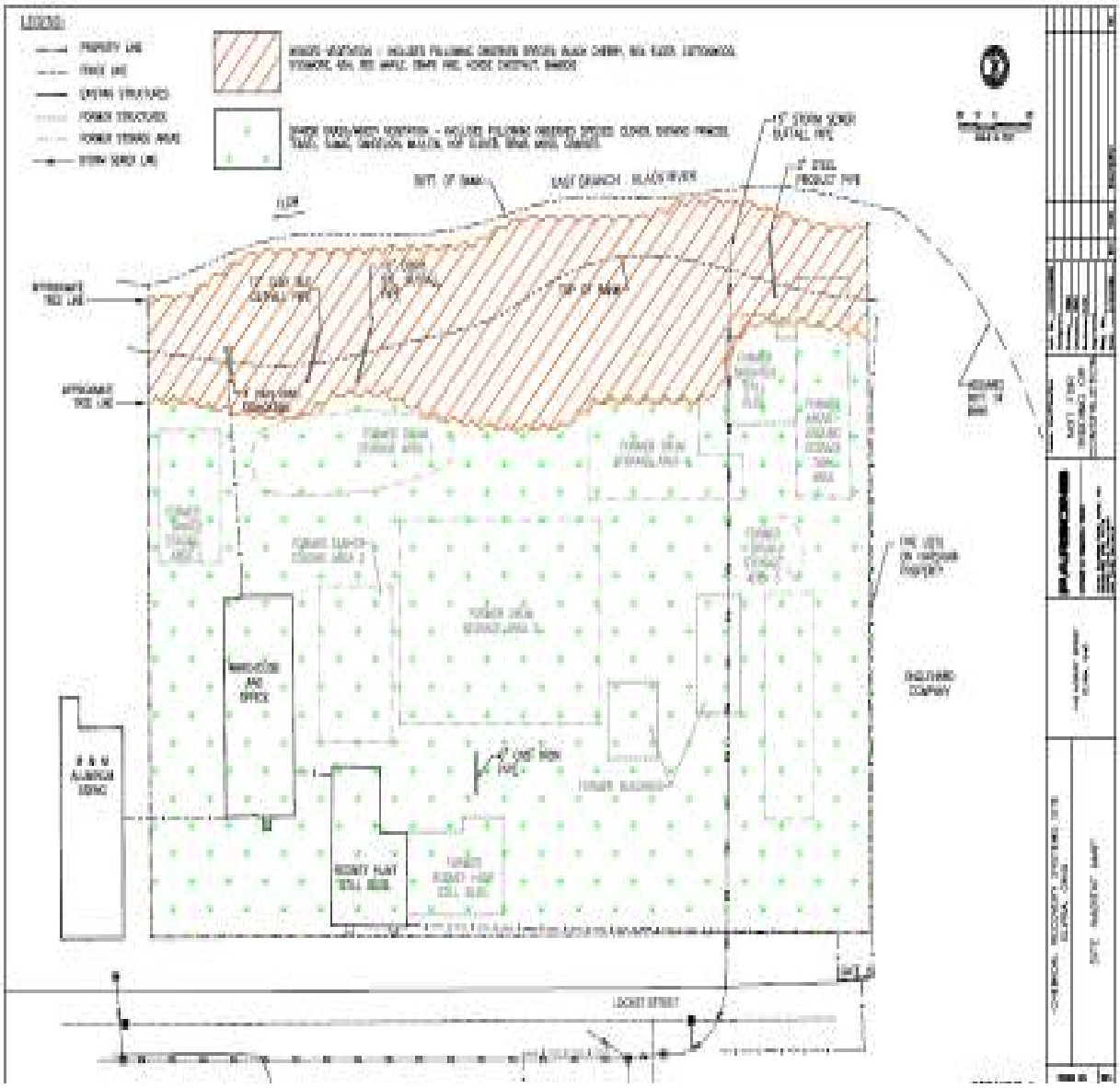
2.5.1 Site Ecology

The CRS Site is 2.5 acres and is essentially level, consisting of a grassy/weedy cover with patches of gravel and asphalt. Surface drainage is westward, towards the River. The western edge of the property is densely vegetated with a steep grade of ten to fifteen feet from the present site to the bank of the River. The CRS Site has approximately 400 linear feet of river frontage on the west. The property is fenced on the northern, eastern, and southern sides, which restricts casual access to the CRS Site. A CRS Site habitat map is included as Figure 2.

2.5.2 Vegetation

The CRS Site consists of a historically industrial area with little natural vegetation, except for the overgrowth in unused areas. Surveys and observations of the species present at the CRS Site were made during site investigation activities conducted throughout the summer of 2003 and during a CRS Site visit in April 2005. Vegetation present at the CRS Site includes a woody area adjacent to the East Branch Black River with dominant plant species being black cherry, box elder, cottonwood, sycamore, ash, red maple, grape vine, horse chestnut, and bamboo. In the former operations area of the CRS Site, vegetation consisted primarily of grasses and other weedy plants such as clover, evening primrose, teasel, sumac, dandelion, mullein, hop clover, and briers. Aquatic vegetation was not directly observed in the East Branch Black River, but various forms of algae are likely to be present in the water column. The nearest wetland area is the adjacent East Branch Black River, a riverine wetland according to the Cowardin wetland classification. The nearest non-riverine wetlands are located approximately 15 miles downstream of the CRS Site (DOI, 1977a, 977b, and 1977c), well beyond any reasonable zone of CRS Site impact.

Figure 2 CRS Site Habitat Map



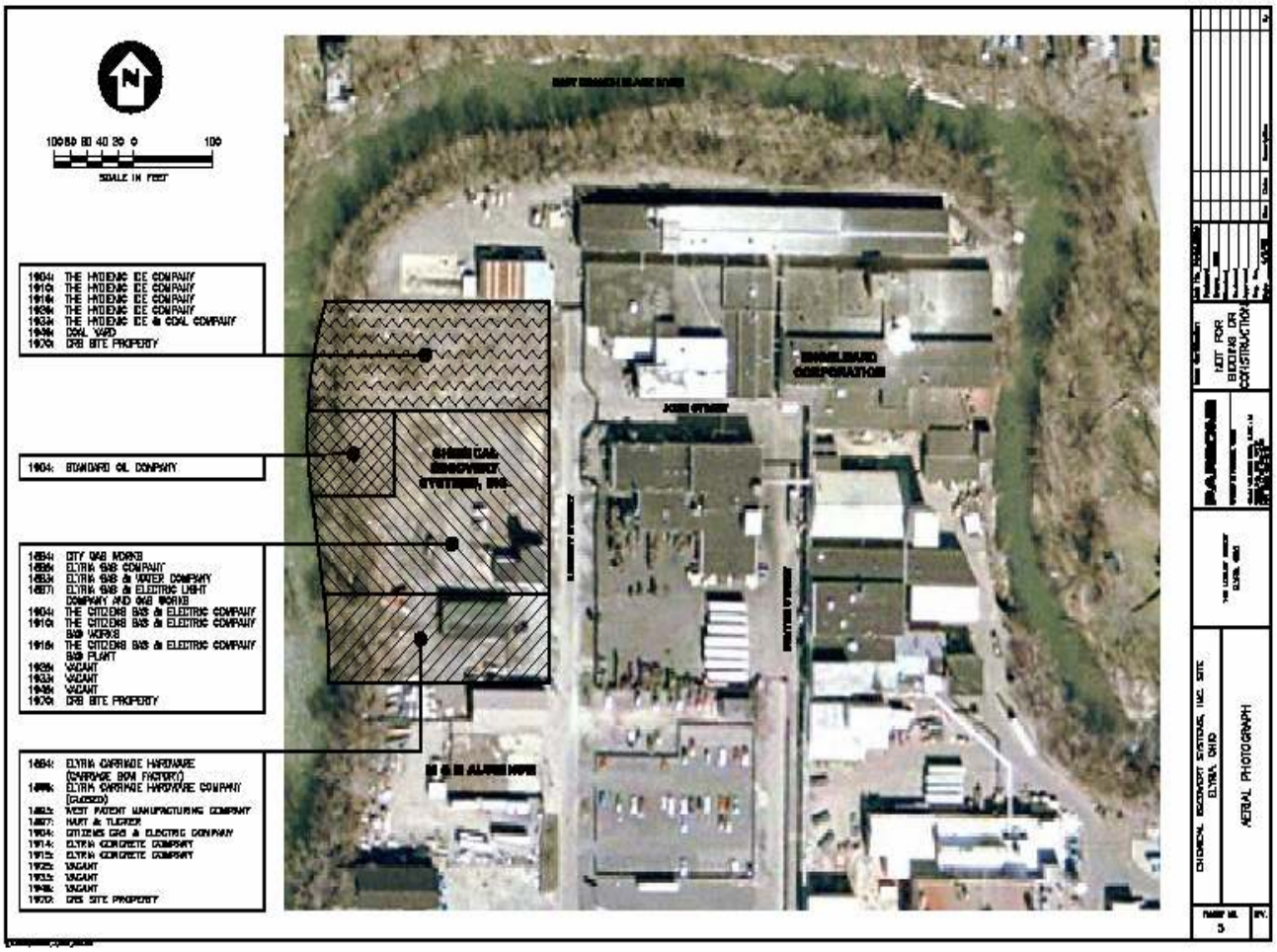
2.5.3 Black River

The Black River watershed is located primarily in Lorain and Medina Counties, but also includes drainage from Cuyahoga, Ashland, and Huron counties. The Black River watershed drains over 467 square miles (298,880 acres) (EPA, 2004). The Black River has two main branches: the East Branch, which drains land in Medina and southeast Lorain Counties, and the West Branch, which drains land primarily in southwest Lorain County (Ohio EPA, 1999). The east and west branches of the Black River meet in Elyria at Cascade Park (approximately 0.7 miles downstream of the CRS Site) to form the main channel, which then flows 15.6 miles north into Lake Erie at the port of the city of Lorain (Ohio EPA, 2004). Overall, 51% of the land

within the watershed is used for agriculture, 38% is rural, 7% is residential, 3% is commercial and 1% is industrial (EPA, 2004). Adjacent to the CRS Site, the East Branch Black River is approximately 100 feet wide and the width is fairly stable given the rock-cliff walls that have a "canyon-like" effect.

The depth of the East Branch Black River adjacent to the CRS Site varies from 2 to 10 feet and the substrate consists primarily of silty clays. An aerial photograph of the CRS Site is included as Figure 5, and additional photographs of the river and the CRS Site can be found in the Remedial Investigation Report Volume IV (Appendix G and H), Revision 3; August 2006.

Photograph 2
Aerial Photograph of the CRS Site Surroundings



The Black River is the only water system in Ohio where the International Joint Commission (IJC) (Ohio EPA, 2004) designates the entire watershed as an Area of Concern. IJC is an independent, binational (United States and Canada) organization that deals with boundary waters. Designation of the Black River watershed as an Area of Concern means that beneficial uses such as fish and wildlife consumption, public swimming beaches and habitat have been impaired throughout the watershed.

Historically, pollution from industrial and municipal wastewater discharges contributed extensively to water quality impairments in the Black River watershed. And, although pollution effects from industrial and municipal wastewater plants have lessened over the years, the Black River watershed is still impacted by other pollution sources. A high residential growth rate, agricultural practices and other land use practices have directly contributed to pollution in the Black River. Soil erosion has also caused significant problems in the Black River watershed, with more than 17,000 acres eroding at excessive levels (Ohio EPA, 2004). In addition, the natural riparian corridor – the buffer strip of natural vegetation along the river and stream banks– along many areas of the Black River has been disrupted, causing significant amounts of run-off to enter the river and its tributaries (Ohio EPA, 2004). Lastly, failing home sewage and semi-public sewage disposal systems has impacted portions of the Black River watershed. These overburdened and often aging and neglected systems have allowed pathogens and nutrients to enter the watershed with minimal treatment. In some of Lorain County's older cities (such as Elyria), rehabilitation of the sewer systems is necessary to reduce the amount of storm water flowing into local wastewater treatment plants (Ohio EPA, April 2004).

Currently, Ohio has issued a statewide advisory for mercury that no more than one meal per week is comprised of any sport fish caught from any Ohio water body. In addition, specifically for the East Branch Black River, Ohio has advised that only one meal per month should be eaten of the following species due to mercury contamination: rock bass, small mouth bass, yellow bullhead and snapping turtle (Ohio Sport Fish Consumption Advisory, 2005).

Additionally, the Ohio Department of Health conducted a risk assessment with recent data from the Black River, which showed that the water and sediment in the river are safe for human contact through wading and swimming. Therefore, the Ohio Department of Health removed the contact advisory for the Black River in April 2004 (Ohio EPA, 2004).

In 1999, Ohio EPA published a report entitled "Biological and Water Quality Study of the Black River Basin, Lorain and Medina Counties." Ohio EPA conducts studies of the Black River on five-year intervals to assess the health of the river. In 1997, the closest Ohio EPA sampling locations to the CRS Site were as follows: the Black River at Cascade Park (approximately 1.2 miles downstream of the CRS Site immediately downstream of the confluence of the East and West Branches), the East Branch at river mile 0.3—the Washington Street Bridge (approximately 0.2 miles downstream of the CRS Site), at river mile 3.00—Fuller Street (approximately 2.5 miles upstream of the CRS Site), and at river mile 5.2—near Willow Creek (approximately 4.7 miles upstream of the CRS Site). Macro-invertebrate samples were collected from each of these locations; while water chemistry samples were collected from Cascade Park, Washington Street, and Willow Creek; fish samples were collected from Cascade

Park, Fuller Street, and Willow Creek; and sediment chemistry samples were collected from Cascade Park (Ohio EPA, 1999).

Flow in the Black River is measured at a USGS gaging station located in Cascade Park at river mile 14.94 (Station # 04200500). This station is approximately 1.2 miles downstream of the CRS Site and is downstream of the confluence of the East and West Branches of the Black River.

During the sampling period (June 30 – September 4, 1997), average daily stream flows ranged from 11 to 173 ft^3/sec. The median daily average flow was 21 ft^3/sec and the mean was 64.9 ft^3/sec (Ohio EPA, 1999). No significant impacts on chemical water quality (i.e., exceedances above applicable Ohio Water Quality Criteria) were observed by Ohio EPA in the East Branch downstream from Willow Creek (river mile 5.2). However, levels of fecal coliform bacteria increased in the East Branch downstream from Willow Creek and within the City of Elyria. Median levels of fecal coliform exceeded the primary contact recreational standard of 1,000-colonies/100 ml in samples collected at Fuller Street, Washington Street and Cascade Park. Potential sources of fecal coliform are failing on-site sewage systems located upstream from the City of Elyria, direct run-off from agricultural and urban areas, and bypasses and overflows within the City of Elyria sewer system (Ohio EPA, 1999). Analysis of sediment samples collected from the East Branch Black River in 1996 and 1997 found no detectable levels of PCBs, SVOCs or toxic pesticides (Ohio EPA, 1999). In addition, heavy metals were found at concentrations considered non-elevated as compared to reference sites in the Erie Ontario Lake Plain ecoregion (EOLP). The exception to this was the sample collected at river mile 11.4 (approximately 11 miles upstream of the CRS Site), where elevated concentrations of copper, iron and zinc were detected. The source of heavy metals is unclear since this location is well downstream of any point source discharges and is upstream of the Grafton Waste Water Treatment Plant (WWTP). However, part of the city of Grafton drains upstream of this sample location; therefore the contamination may reflect urban and suburban runoff (Ohio EPA, 1999). Additionally, the lack of significant concentrations of chemical pollutants in the East Branch sediments may be partially explained by the high percentage of sand in the stream sediments. Fine-grained sediments tend to adsorb chemical contaminants, especially organic compounds much more readily than large grained, sandy sediments. Chemical water quality in the East Branch Black River has improved dramatically from when data was first collected from the river in 1982. Violations of water quality criteria for dissolved oxygen were common at the mouth of the East Branch (near the CRS Site) in 1982, and ammonia (as NH_3-N) concentrations were elevated. In addition, concentrations of various heavy metals were also elevated in 1982. Since that time, dissolved oxygen concentrations have recovered to acceptable levels and NH_3-N concentrations are routinely near or below the analytical detection limit (Ohio EPA, 1999). The only parameter that has higher concentrations now than in 1982 is total suspended solids (TSS), for which concentrations have nearly doubled. Increases in TSS concentrations are probably reflective of increasing non-point source pollution pressures in the watershed resulting from riparian zone degradation and urbanization with coincident increases in erosion and sedimentation from runoff (Ohio EPA, 1999).

Habitat impacts associated with agriculture and encroachment into riparian areas were more common in the East Branch than the main-stem; consequently, the ratio of modified warm-water-habitat attributes increased relative to the main-stem. The channel in areas where the river

flows over bedrock was wide in comparison to the amount of flow suggesting that historic loss and present lack of mature hardwoods along the banks allowed the river to widen. Wide shallow channels reduce current speed, and loss of woody debris reduces habitat complexity. Despite these modified habitat attributes, the habitat was amenable to supporting warm-water communities as judged by a mean Qualitative Habitat Evaluation Index (QHEI) of 65.6. Substrates were not unusually embedded with silt, however riffles were moderately embedded. Cobble, boulder and slab structures from glacial till and fractured bedrock provided in-stream cover at most locations in the lower reach of the East Branch (Ohio EPA, 1999). Macro-invertebrates communities were evaluated at nine locations on the East Branch from river miles 40.4 to 0.1 and at Cascade Park on the main-stem. The communities were very good to exceptional at all sites (Ohio EPA, 1999). Total taxa (number of species) ranged from 52 to 70, and total Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa (mayflies, stoneflies and caddisflies, which are pollution sensitive species) ranged from 14 to 23. These results were similar to the 1992 results, except the 1992 results showed that the East Branch was adversely impacted immediately downstream of the Grafton WWTP. The macro-invertebrate communities in the lower reach of the East Branch (near the CRS Site) were evaluated in 1982 as "good" at river mile 3.1 (Fuller Road) and "poor" at river mile 0.2 (near the Washington Street bridge).

The 1992 data, and especially the 1997 data, documented significant water resource improvement at the lower sites, which was attributed to decreases in combined sewer outfall (CSO) discharges (Ohio EPA, 1999).

The fish community was rated as "good to marginally good" at locations both upstream and down stream of the CRS Site (Ohio EPA, 1999). This is an improvement from 1992 when the fish community was evaluated as "fair" (downstream) to "good/marginally good" upstream of the CRS Site and from 1982, when the fish community was rated as "poor/very poor". The legacy of non-point pollution and habitat degradation were evident in the absence of intolerant species, and low numbers of darter and sucker species. However, the proportion of simple lithophilic and insectivorous fishes increased in 1997 relative to 1992, suggesting a lessening of non-point related impacts (Ohio EPA, 1999).

Ohio EPA collected the most recent fish tissue samples from the East Branch of the Black River in 2000. The closest upstream sampling site was at Fuller Road, approximately 2.5 miles upstream. Samples were collected of rock bass, small mouth bass and yellow bullhead and analyzed for mercury, PCBs, pesticides, arsenic, cadmium, lead, and selenium. Mercury and selenium were the only two compounds detected in any of the fish tissue samples. No down stream fish tissue samples were collected from the East Branch in 2000. The closest downstream station that was sampled for contaminants in fish tissue was on the main-stem of the Black River at river mile 9.8, at the Ford Road Bridge, approximately 11 miles downstream of the CRS Site. Six different fish species were sampled at this location in 2002 (the most recent sampling date) including largemouth bass, common carp, channel catfish, yellow bullhead, freshwater drum and rock bass. Each sample was analyzed for mercury, PCBs, pesticides, arsenic, cadmium, lead, and selenium. Mercury, several PCBs, several pesticides, cadmium, lead, and selenium were detected in at least one fish sample collected from this location (Ohio EPA, 2005).

In addition to being located in a highly urbanized area, the CRS Site is located on a portion of the East Branch that is situated between two low head dams. The dams are located at

the East Street (approximately 2,500 feet upstream) and Washington Street (approximately 1,600 feet downstream) bridges. Dams dramatically alter a river's flow regime by blocking a river's passage, storing water in both large and small artificial reservoirs, and disrupting the cycles that many aquatic organisms depend upon (American Rivers, 2002). The slower water flow and larger surface area created by dams can alter the species composition of organisms in the river, favoring slower-moving aquatic species that are better adapted to lake-like bodies of water. Additionally, because of the increase in water depth and decrease in flow velocity created by a dam, the dammed area may separate into several layers of water with varying temperatures, a process known as temperature stratification. The top layer of the water (epilimnion) will warm and decrease in density, while cooler, denser water will sink to the bottom layer (hypolimnion) of the reservoir. If the water is deep enough, the bottom and top layers often do not mix well, inhibiting gas transfer between the highly oxygenated surface layers and the poorly oxygenated bottom layer (American Rivers, 2002).

Dams also block the movement of sediment within a river, depositing much of the material behind the dam and altering the river's habitat. Sediment accumulation behind the dam restricts the amount and types of sediment that reach areas downstream, as well as the habitat available within the reservoir. Furthermore, because dams restrict the flow of rivers, dammed rivers often can no longer distribute large material such as boulders and cobbles downstream. Once a dammed river has lost the ability to transport large materials, the streambed begins to rise, exacerbating habitat loss. In addition to rising streambeds, smaller material (i.e., sand and silt) often settles close to the dam and slowly fills the water body. Downstream of a dam, sediment starved rivers often regain sediments lost behind a dam by eroding deeper into the river channel and away at the stream banks. Consequently, the river channel may become coarse, encouraging stream bank erosion and the disappearance of riffles. Together, stream bank erosion and channel incision can render the remaining river habitat inhospitable for many organisms, altering the community of species that live in the stream (American Rivers, 2002). Thus, the CRS Site location between two low-head dams has likely negatively impacted the quality of the aquatic habitat at and near the CRS Site, resulting in fewer and more tolerant species.

2.5.4 Conceptual Site Model

2.5.4.1 Conceptual Site Model (Human Receptors)

Under the current exposure scenario as a vacant storage facility, the potential receptors identified include occasional commercial CRS Site visitors and CRS Site trespassers. Based on the historical industrial use of the CRS Site, the zoning, and the active industrial use of the surrounding land, the reasonably anticipated future use of the CRS Site is to remain industrial. The receptors identified under the reasonably anticipated future industrial land use include commercial/industrial workers, construction workers, and CRS Site trespassers. Although the potential of the CRS Site to become a residential property is extremely unlikely, a hypothetical residential scenario was also evaluated. The risks to a current occasional commercial CRS Site visitor, a future commercial/industrial worker, a future construction worker, a current/future trespasser, and a hypothetical future resident were quantified via calculation of daily intake and comparison to acceptable reference doses. The potential exposure pathways evaluated for the CRS Site include soil ingestion, soil dermal contact, inhalation of particulates in surface soil,

inhalation of soil volatile chemicals in indoor and outdoor air, inhalation of groundwater volatile chemicals in indoor and outdoor air, sediment direct contact and surface water dermal contact. The groundwater potable use exposure pathways are not completed at the CRS Site because municipal water is provided to the CRS Site, no drinking water sources are identified at the CRS Site or surrounding area, and the impacted groundwater is not and is unlikely to be used as a drinking water source. However, a hypothetical groundwater use scenario was also evaluated for informational purposes.

The Conceptual CRS Site Model developed in the Baseline Human Health Risk Assessment (BHHRA) is presented in Table 1.

TABLE 1 CRS Conceptual Site Model (Human Receptors)

Scenario	Receptor	Exposure Pathway (s)	Exposure Route
EPS - 1 Current Use	Commercial Site-Visitor	Surface Soil	Incidental Ingestion
			Dermal Contact
			Inhalation of Particulates
			Inhalation of Volatiles
		Groundwater	Inhalation of Volatiles (Indoor Air)
EPS - 2 Current Use	Juvenile Trespasser	Surface Soil	Incidental ingestion
			Dermal Contact
			Inhalation of Particulates
			Inhalation of Volatiles
		Groundwater	Inhalation of Volatiles (Indoor Air)
EPS - 3 Future Use Outdoor	Industrial Worker	Soil	Incidental Ingestion
			Dermal Contact
			Inhalation of Particulates
			Inhalation of Volatiles
Exposure Point Scenario			

Scenario	Receptor	Exposure Pathway (s)	Exposure Route
EPS – 4 Future Use Indoor*	Industrial or Commercial Worker	Soil Vapors	Inhalation of Volatiles
		Groundwater *Inhalation of soil & groundwater volatiles. These exposure pathways would be complete only if a building is constructed over the impacted area. **Vapor to indoor air may require further investigation if a building is placed on site*	Inhalation of Volatiles
EPS – 5 Future Use	Construction Worker	Soil	Incidental Ingestion
			Dermal Contact
		Groundwater	Incidental ingestion
EPS –6 Future Use	Juvenile Trespasser	Soil	Incidental ingestion
			Dermal Contact
			Inhalation of volatiles
		Groundwater	Incidental ingestion
			Dermal Contact
			Inhalation of volatiles
		Surface water	Incidental ingestion
			Dermal Contact
			Inhalation of volatiles
		Sediment	Incidental ingestion
			Dermal Contact
			Inhalation of volatiles
EPS-7 Hypothetical Use Indoor	Resident (Child and Adult)	Soil	Incidental ingestion
			Dermal Contact
			Inhalation of volatiles
		Groundwater	Incidental ingestion
			Dermal Contact
			Inhalation of volatiles

Scenario	Receptor	Exposure Pathway (s)	Exposure Route
EPS – 8 Hypothetical Use (Indoor gas)	Resident (Child & Adult)*	Soil vapors	Inhalation of volatiles
		Groundwater vapors **Vapor to indoor air may require further investigation if a building is placed on-site*	Inhalation of volatiles
EPS – 9 Hypothetical Use	Resident (Child & Adult)	*Groundwater **Ingestion of deep groundwater (private water well user)*	Incidental ingestion

TABLE 1 cont. CRS Conceptual Site Model (Human Receptors)

2.5.4.2 Ecological Conceptual Site Model

Under current conditions, terrestrial receptors that might be present on-site are those species that are typical urban species or those that have adapted to disturbed conditions, including mice, shrews, muskrat, mink, squirrels, bats, and various species of birds. Most of these larger species are only expected to utilize the CRS Site as a travel corridor to get to a preferred feeding or nesting area. Evidence of beaver activity at the edge of the CRS Site has been observed (gnawed tree trunks along the river bank), although use of the CRS Site by beaver appears to be limited to an occasional foraging area. Potential aquatic receptors present within the River include the benthic macro-invertebrate community, fish community (comprised predominantly of small mouth bass, rock bass, greenside darter, and sand shiner), waterfowl, reptiles (turtles and water snakes), amphibians, and piscivorous birds (e.g. the great blue heron).

The Indiana bat (*Myotis sodalis*), and the bald eagle (*Haliaeetus leucocephalus*) are listed endangered species known to inhabit Lorain County, and may inhabit areas along the Black River within 15 miles downstream of the CRS Site (DOI, 1994). There are no existing or proposed state natural preserves or scenic rivers at the CRS Site. There are also no known geologic features, breeding, or non-breeding animal concentrations, champion trees, or state parks, forests, or wildlife areas in the vicinity of the CRS Site or within a half mile radius of the CRS Site (ODNR, 2004)

Due to the long-term urbanization of the area surrounding the CRS Site (the property has been in continual industrial use since the late 1800's), there is little natural habitat available for wildlife on the CRS Site, except for a small area immediately adjacent to the East Branch of the Black River. While the East Branch of the Black River may attract ecological receptors to the area, the steepness of the riverbank and the limited amount of riparian vegetation along this riverbank do not provide suitable habitat for most ecological receptors. Additionally, the presence of nearby dams limit the quality of the habitat available for benthic invertebrates.

Therefore, the CRS Site is not expected to be preferentially attractive to area wildlife. However, since some ecological receptors, such as beaver, do access the riverbank (as evidenced by observations of gnawed tree trunks at the CRS Site, photograph 3), the potential risks specifically to aquatic mammalian herbivores were also evaluated under the conservative assumption that the CRS Site is used as a primary foraging area and den. The Conceptual Site Model developed in the Ecological Risk Assessment (ERA) is presented in Figure 3 below.

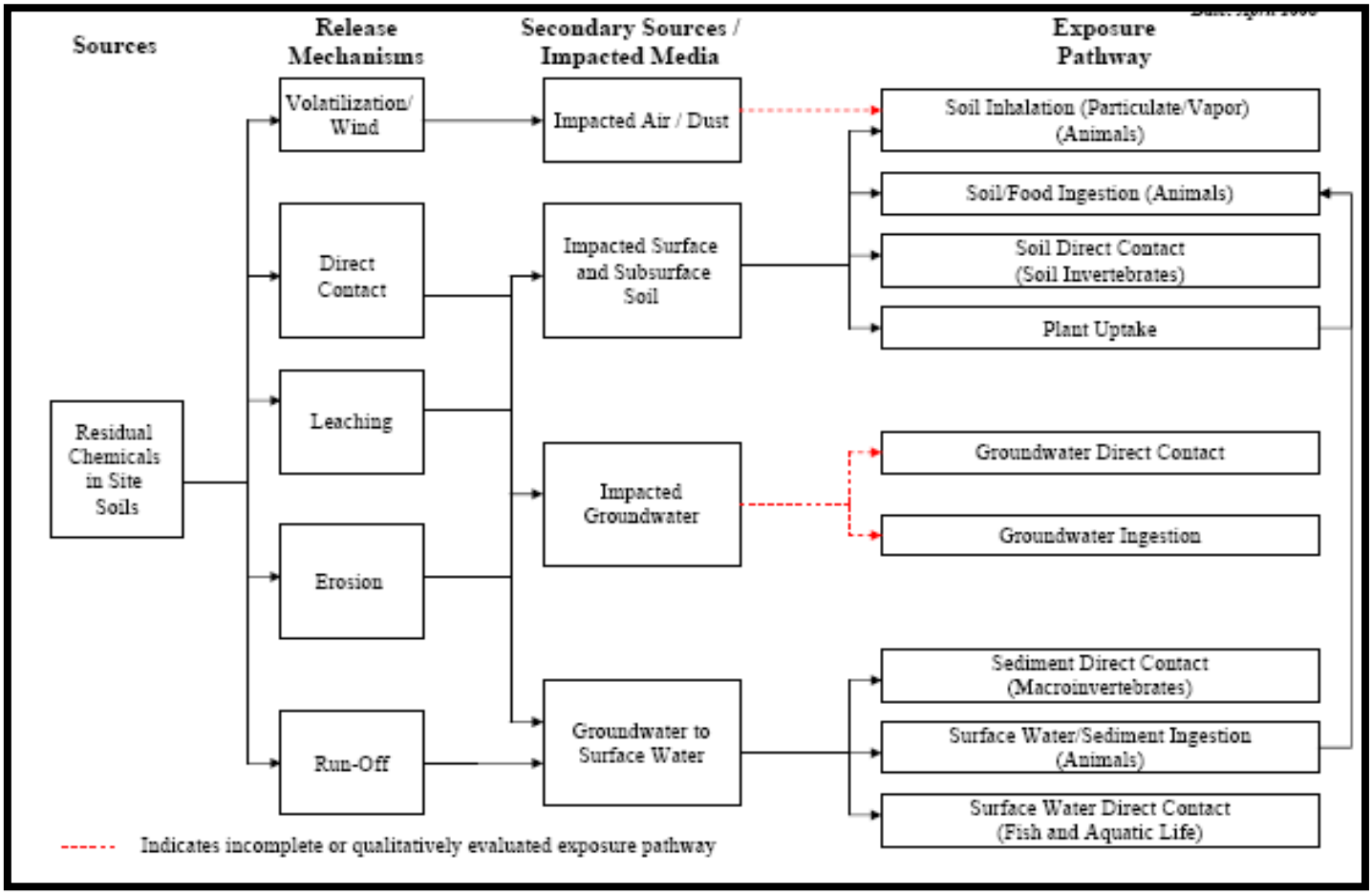


Figure 3 Conceptual Site Model (Ecological)

2.5.5 CRS Site Overview

In general, the Elyria area climate is moderated by Lake Erie, resulting in mild but snowy winters and warm, humid summers. The area is periodically subject to severe thunderstorms and tornadoes. Climatological data presented in this section are from the Cleveland, Ohio reporting station for the National Oceanic and Atmospheric Administration (NOAA), for the reporting period of 1944 through 1990.

The average annual precipitation is 36.63 inches, which consists of both rainfall and snowfall. Precipitation is primarily in the form of rain during the period of April through September. Annual total snowfall averages 56.5 inches. Normal daily mean temperature is 49.6°F. The normal daily maximum and minimum temperatures at the Cleveland station are 58.7°F and 40.5°F, respectively. Annual low temperatures typically occur in January. Surface soil temperatures in Ohio drop below freezing during the months of December through March. Prevailing winds are from the south, with an average speed of 10.5 mph.

According to the City of Elyria, Ohio website, the population of Elyria is 56,283 and the land area of the city covers 19.9 square miles. The land use for the CRS Site and surrounding area is commercial and industrial. The future plan for the area is to remain commercial and industrial.

No drinking water wells are located within one mile of the CRS Site. No groundwater-based municipal water supply systems are located within a four-mile radius of the CRS Site (PRC, 1995c). No surface water intakes along the River exist within 15 miles of the CRS Site (ATSDR 1999, EPA 1995).

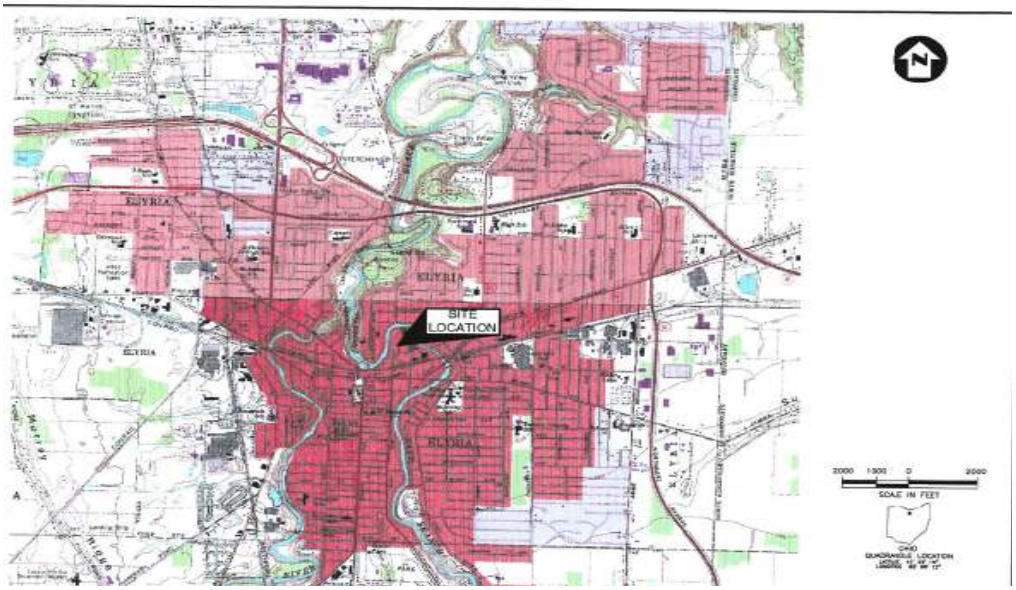
2.5.6 Surface and Subsurface Features

A concrete slab foundation of a former building is located in the northwest corner (NW) of the property. In addition, the concrete slab foundation believed to be from the Brighten Still building and the secondary containment dike for the former AST farm remain in the northwestern corner of the CRS Site, although all tanks have been removed. Two sumps remain on-site. One sump is located in the "shell" of the Rodney Hunt Building. The second sump is located in the area where the former Brighten Still Building stood. Four pipes (subsurface conduits) were observed along the western boundary of the property along the River. The primary subsurface conduit is a storm sewer pipe that runs from Locust Street under the CRS Site to the River. A manhole on Locust Street provides access to the Storm Sewer, which drains run-off from BASF, formerly Engelhard Chemical Company and other industrial sites. Cars, trucks, wood waste, and other debris were also located on the property.

The CRS Site is essentially level and consists of a grassy cover with patches of gravel and asphalt. Surface drainage is westward, towards the River. The western edge of the property is heavily vegetated with a steep grade from the present CRS Site to the bank of the River. The property is fenced on the northern, eastern, and southern sides, which restricts casual access to the CRS Site.

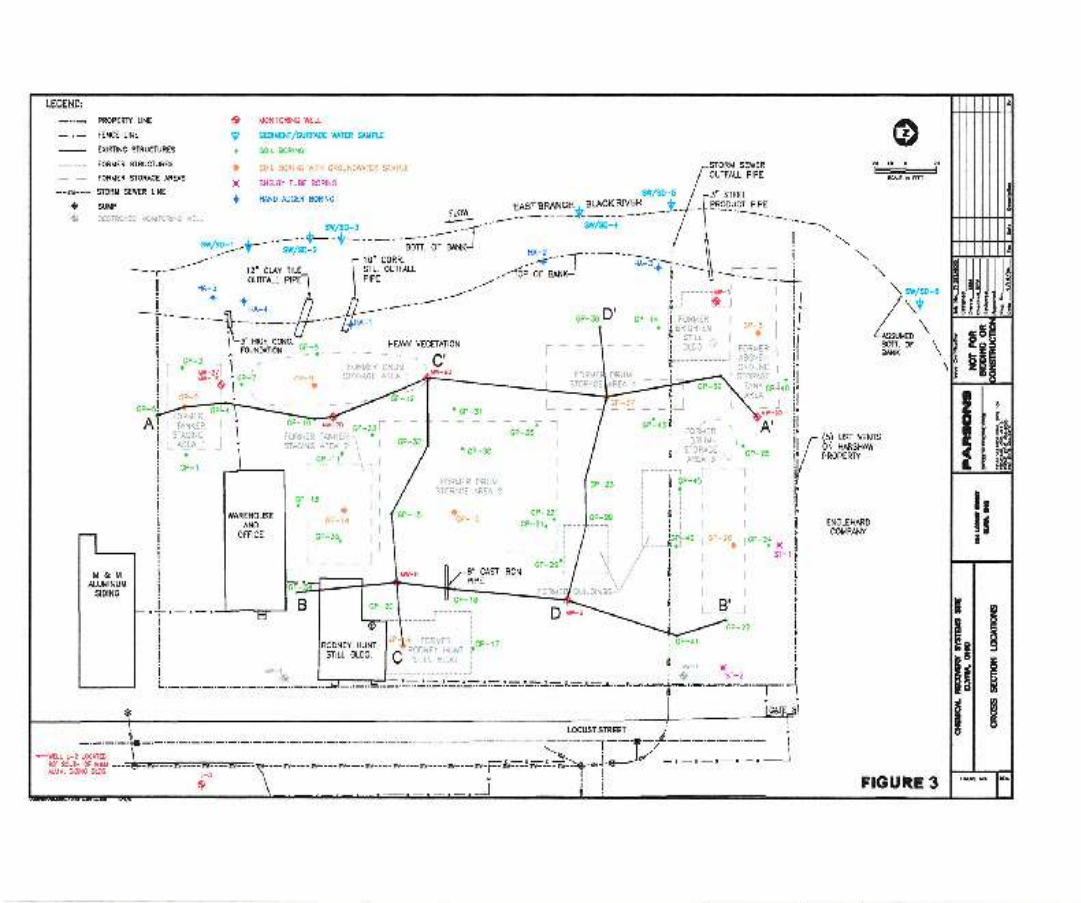
The CRS Site is located adjacent to the meandering River (Figure 4), which has cut a deep gorge into the Berea Sandstone bedrock. The CRS Site is situated on a thin cover of unconsolidated, man-made fill material, predominantly composed of gravel, sand, silt, and clay, including bricks, slag, cinders, construction debris, etc.

Figure 4 CRS Site Aerial East and West Branches Forming the Black River



The unconsolidated material ranges in thickness from four to 20 feet. In general, the unconsolidated material trends towards a thickening towards the River, but is not uniform across the CRS Site. Based on the boring logs from the RI, four cross sections (A-A', B-B', C-C', and D-D') have been constructed (Figure 5). The piezometric groundwater surface is as much as 11 feet below the bottom of the unconsolidated material. Cross-sections A-A' and B-B' represent transect running north to south (Figures 5-1 and 5-2, respectively). Cross-sections C-C' and D-D' represent transect running east to west (Figures 5-3 and 5-4, respectively). An unconsolidated materials thickness map is included as Figure 8.

Figure 5 CRS Site Cross Sections A-A' through D-D'



The unconsolidated materials at the CRS Site are underlain by the Mississippian-aged, medium brown Berea Sandstone Formation, which overlies the gray Bedford Shale (Figures 5-1 through 5-4). Berea Sandstone bedrock is located at approximately four feet bgs on the eastern portion of the CRS Site, and occurs at approximately 20 feet bgs on the western side, near the River, and ranges in thickness from 23 to 25 feet thick. The Berea Sandstone beneath the CRS Site is a fine-grained, arenitic sandstone that is poorly indurated and lithified by silica cement. The sandstone is initially unsaturated when first encountered. Groundwater is encountered after advancing approximately five to 10 feet into the Berea Sandstone.

Figure 5-1 CRS Site Cross Section A-A'

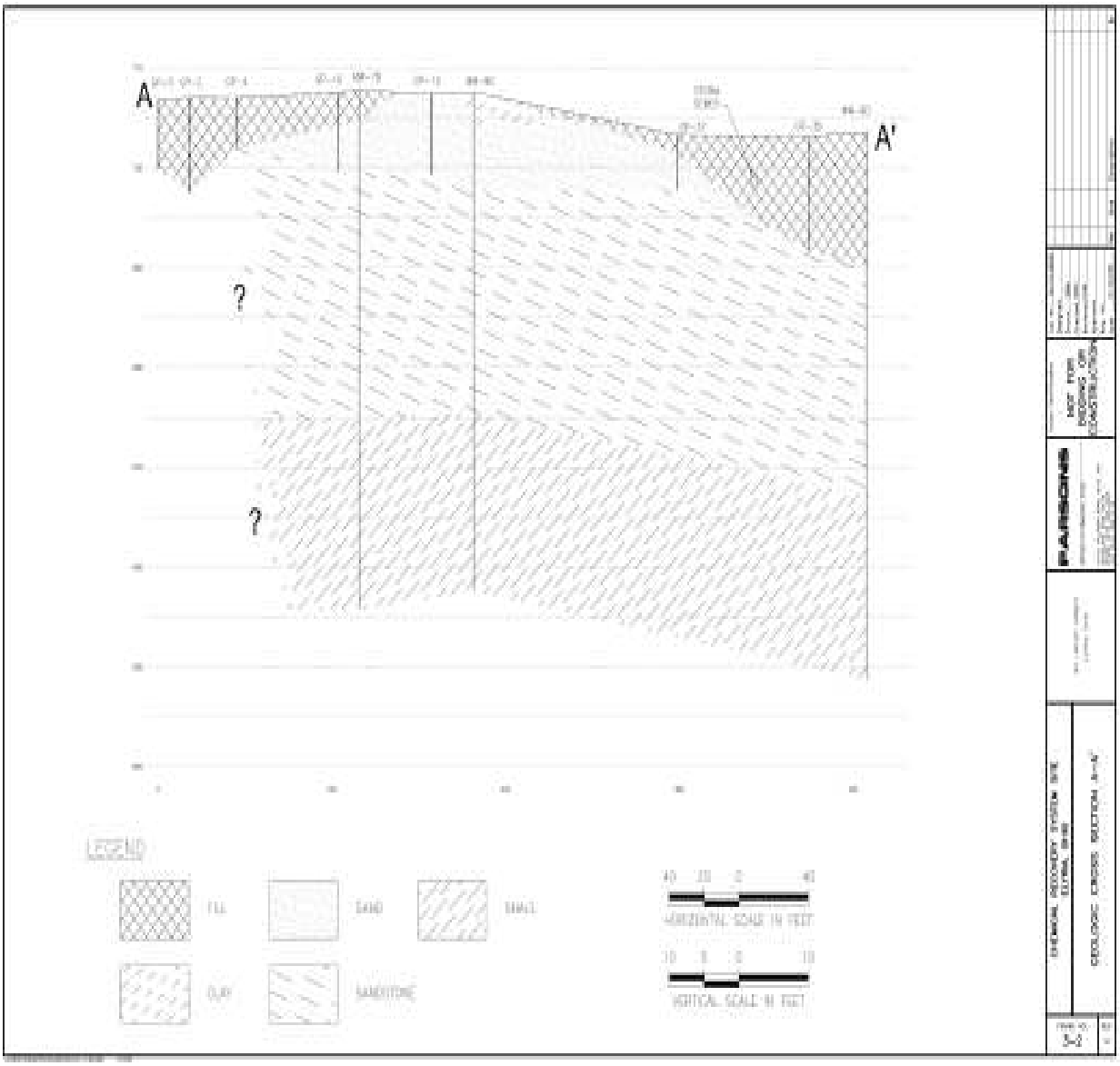


Figure 5-2 CRS Site Cross Section B-B'

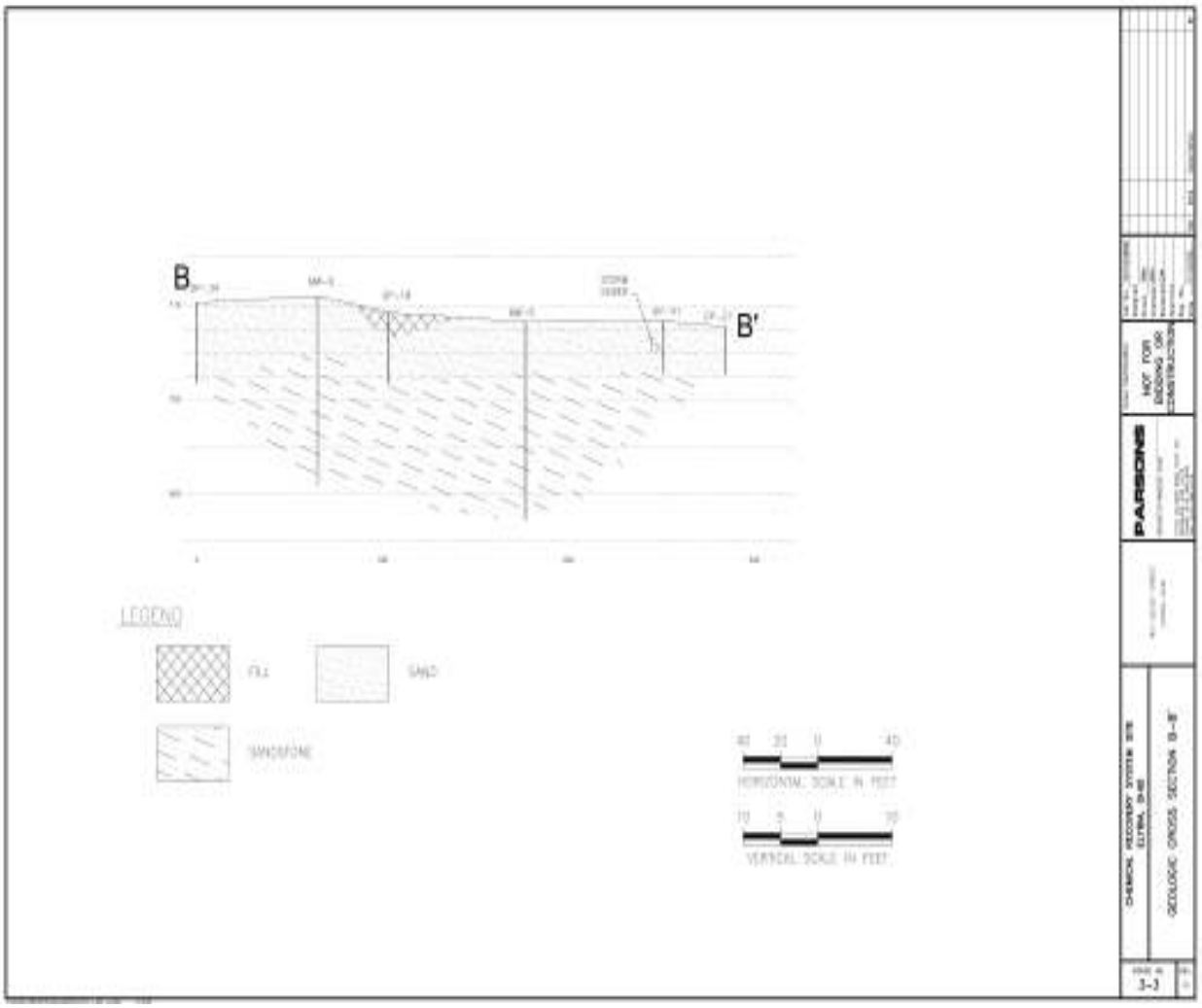


Figure 5-3 CRS Site Cross Section C-C'

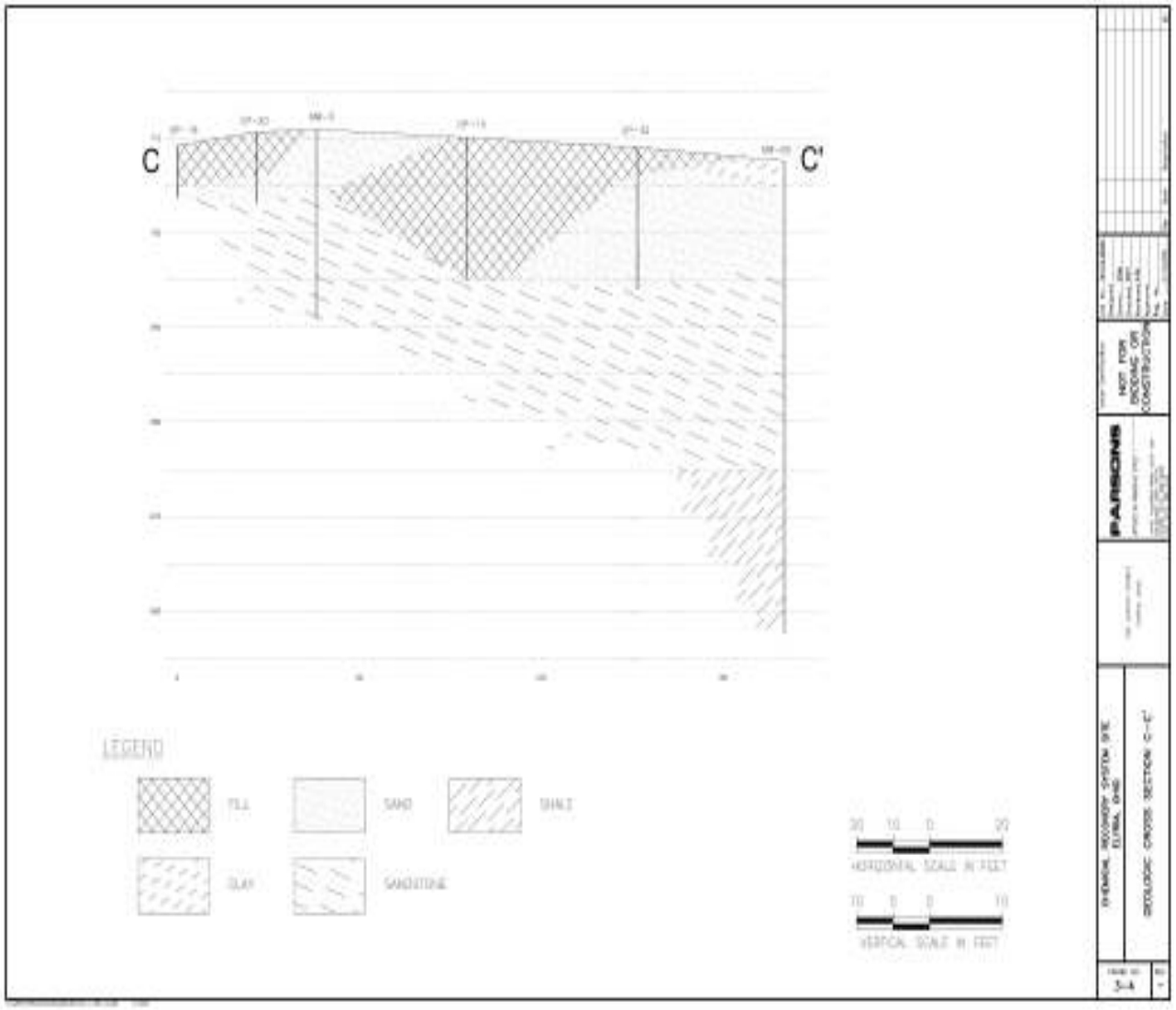


Figure 5-4 CRS Site Cross Section D-D'

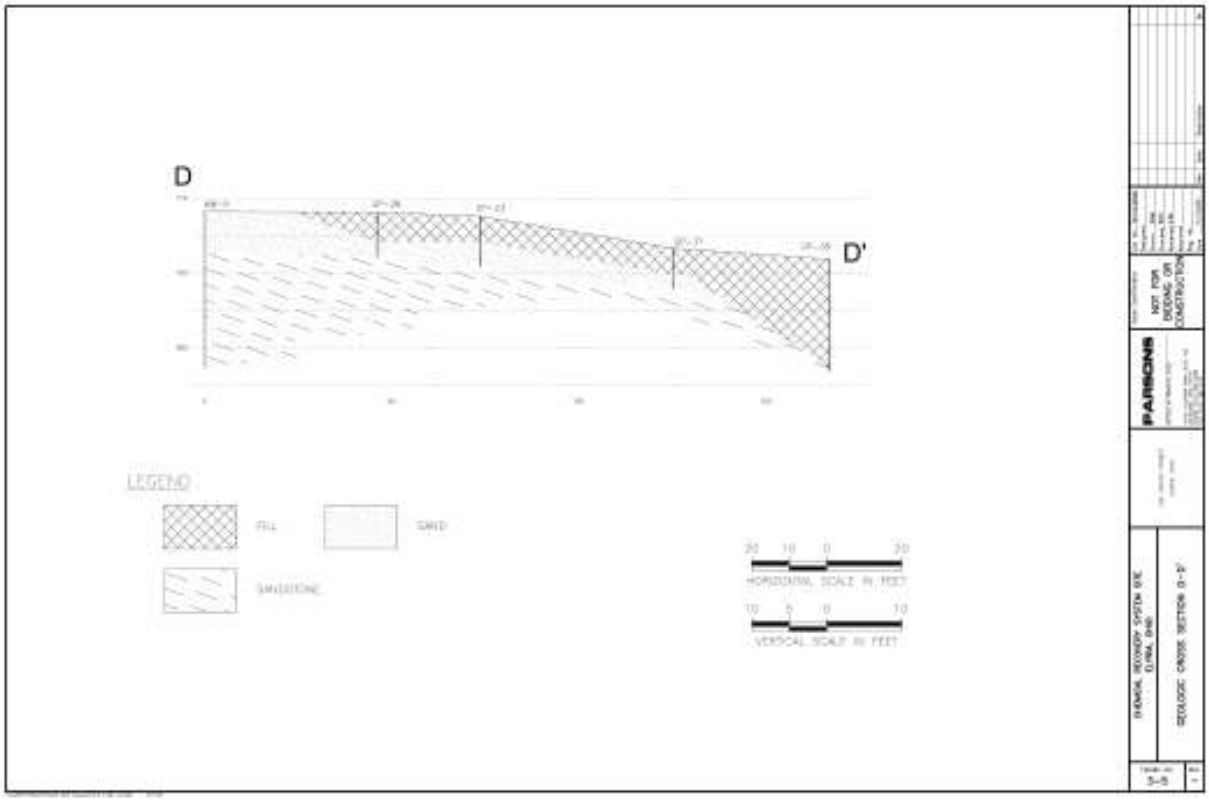
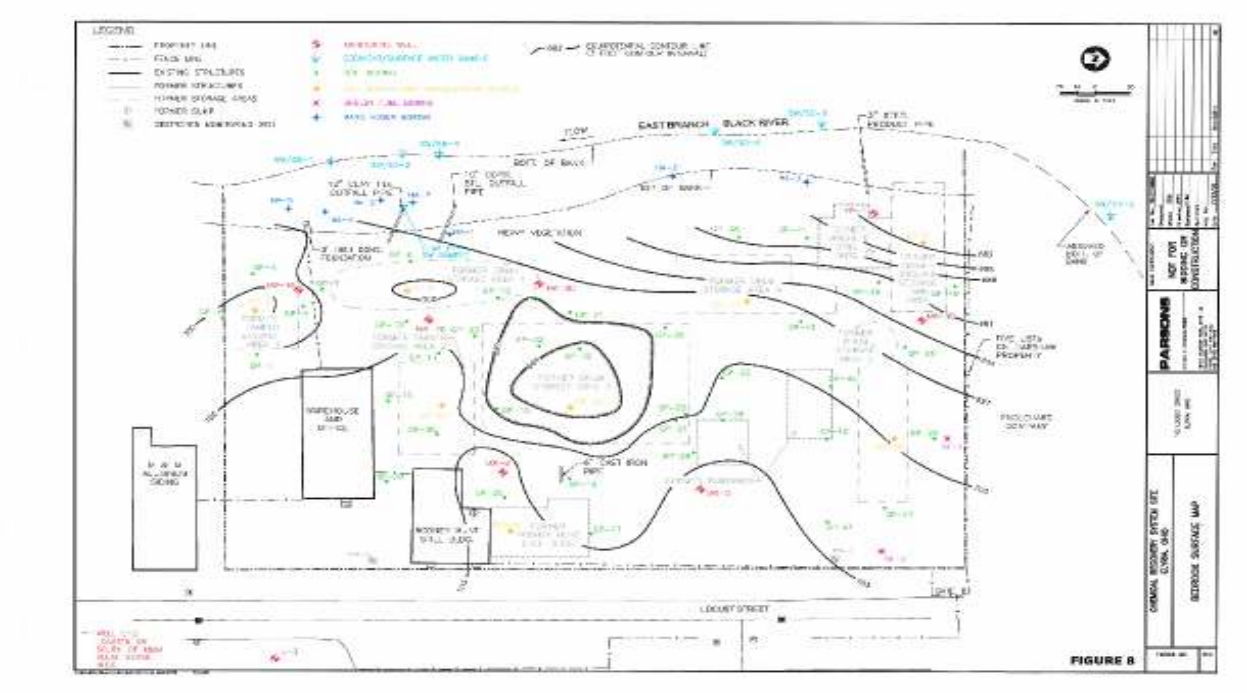


Figure 8 CRS Site Bedrock Surface Map



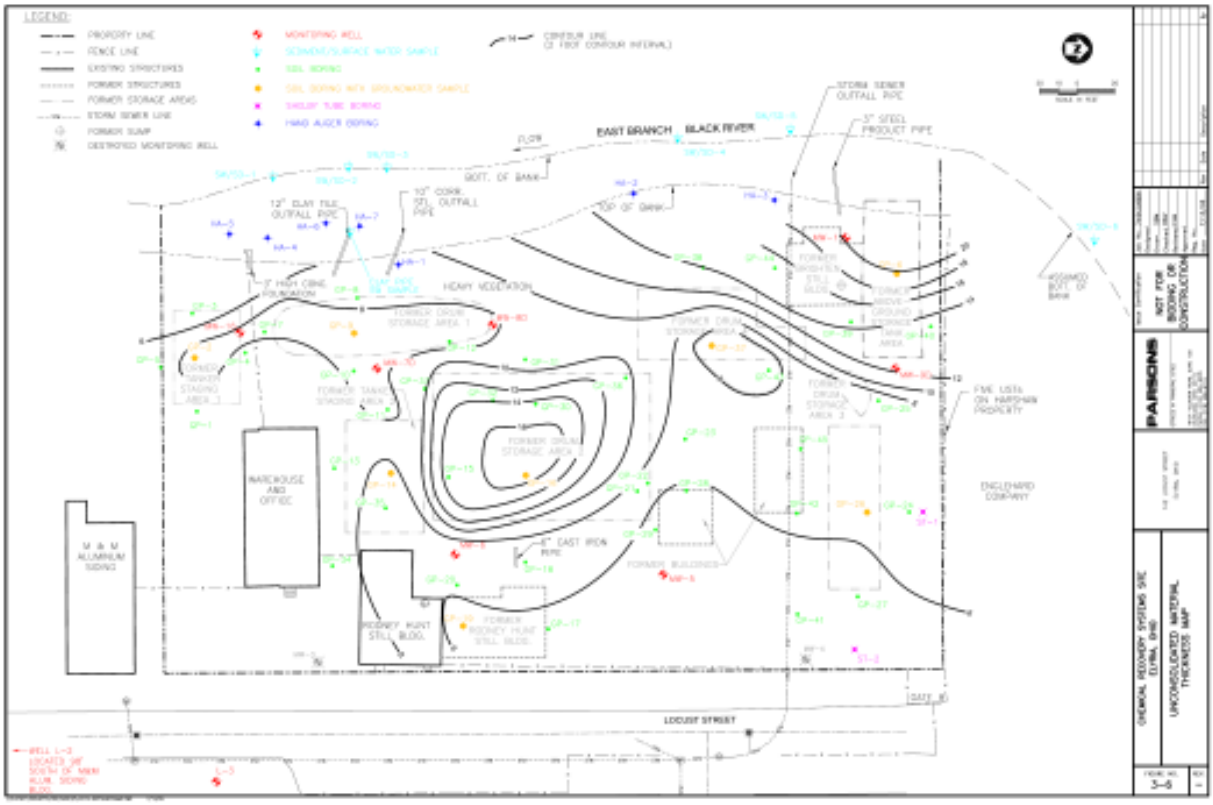
The surface topographic relief across the CRS Site is very low, with greater relief near the bank of the River. A bedrock surface map constructed from borings logs depicts the tops of the Berea sandstone dipping towards the River (Figure 8). The dip of the bedrock is not uniform, and there is a depression in the center of the CRS Site, in the area of Former Drum Storage Area 2 (Figure 8-1).

The Bedford Shale was encountered beneath the Berea Sandstone in the three deeper monitoring wells installed during the RI. The Bedford Shale was encountered between 31 and 35 feet bgs. The shale is initially unsaturated, but groundwater is ultimately encountered after advancing five to 10 feet into the shale. The shale is at least 20 feet thick at the CRS Site.

The unconsolidated material at the CRS Site is unsaturated (Figure 9), as only three of eight temporary monitoring wells contained water. Groundwater was encountered in all permanent monitoring wells, which were installed in bedrock. The sandstone water bearing unit (Berea Sandstone) and the shale water-bearing unit (Bedford Shale) appear to have similar hydraulic heads.

Figure 8-1 CRS Site

Bedrock Surface Depression



Based on two sets of depth to water measurements (Figure 9 and 10) from monitoring wells, the groundwater flow is from the east to the west (towards the River)**.** In addition, the River appears to be a gaining river, as the water table is at or above the river elevation.

Elyria is located within the Black River Basin in the north central portion of Ohio. The primary drainage systems in the Black River Basin are the River. The River flows north through Lorain County to Lake Erie.

Figure 9 CRS Site Groundwater Flow

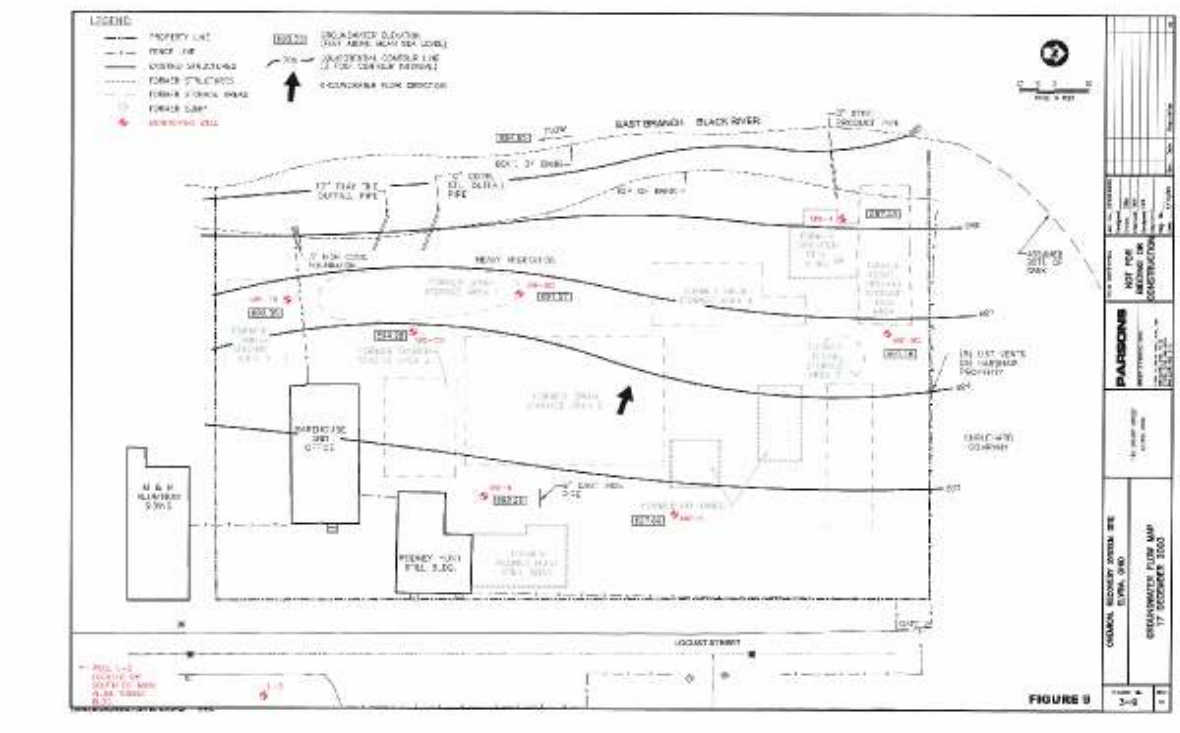
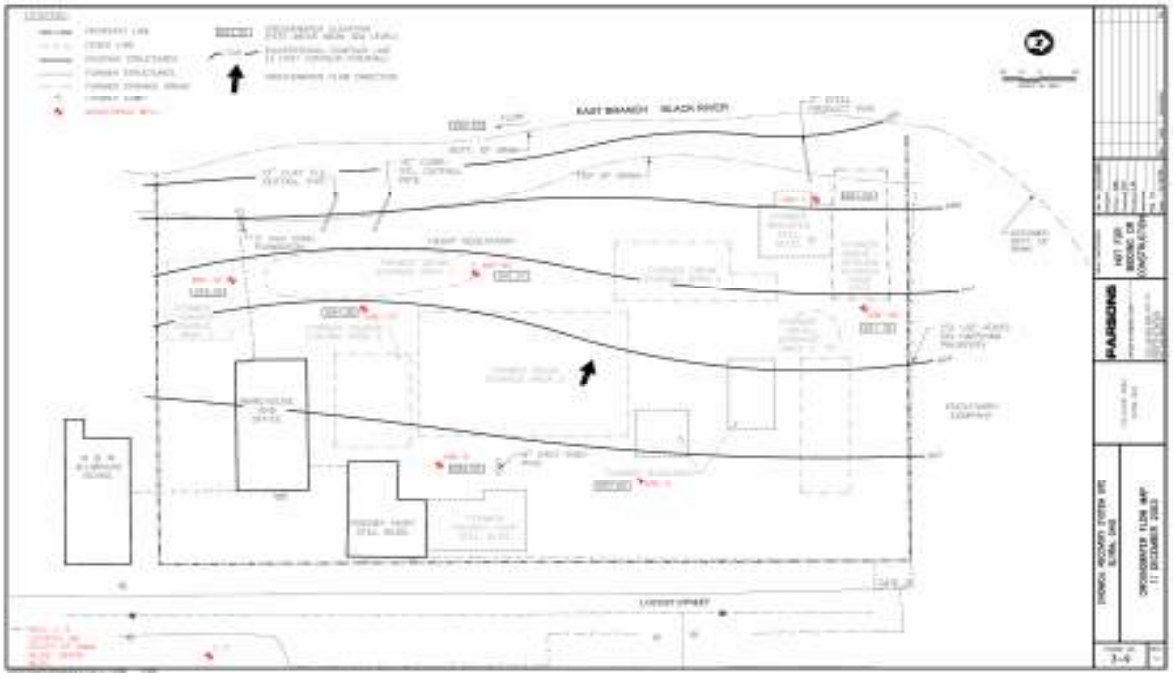


Figure 10 CRS Site Groundwater Flow



Storm water run-off from the CRS Site is directed to the river from surface drainage. A storm sewer, which runs under the CRS Site and discharges directly into the river, is a conduit for off-site surface drainage from Locust Street and the areas draining into the street.

2.5.7 Sampling Strategy

Prior to 2003, several environmental assessments have been conducted at the CRS Site and the adjacent property, which is currently owned by BASF (formerly Engelhard Chemical Company, and formerly Harshaw Chemical Co.). Remediation has also been conducted at the CRS Site and adjacent property.

EPA approved a sampling plan, in consultation with Ohio EPA to identify the presence, extent, and magnitude of chemicals of concern (COCs) in the CRS Site's soil, groundwater, surface water, and sediment.

During the RI over one hundred locations were sampled during the years of 2003 through 2005. The samples were analyzed for VOCs, SVOCs, Pesticides, PCBs, and Metals. During the Ecological Risk Assessment, 6 sediment and 6 surface water samples were collected and analyzed for VOCs, SVOCs, Pesticides PCBs and Metals.

The CRS Site RI was conducted in a phased approach. The first phase and second phase was conducted from July 2003 through November 2003; the third phase was conducted during April and June 2005.

The first phase of field activities included the installation of 40 soil borings (GP-1 through GP-40) (including temporary monitoring wells GP-2, GP-6, GP-9, GP-14, GP-16, GP-19, GP-26, and GP-37). During this time, soil samples were collected from all soil borings and submitted for laboratory analyses. Five surface soil samples (hand auger sample locations HA-1 through HA-5) were also collected from the top of the bank of the River.

Additional field activities were initiated to include sampling of the temporary monitoring wells. During this time, it was determined that only three of the temporary monitoring wells (GP-6, GP-14, and GP-16) had sufficient groundwater to sample, and only one (GP-16) had sufficient groundwater to collect the full complement of samples required for all of the required analyses. In addition, surface water and sediment samples were collected along the River.

Due to a power outage in the Akron/North Canton, Ohio area on 18 August 2003, the surface water and sediment VOC samples collected from the River on 13 August 2003 reached temperatures exceeding 15 degrees Centigrade. Therefore, surface water and sediment samples were collected again specifically for VOC analysis at the identical locations as the earlier sampling event.

The second phase of field activities was conducted during October and November 2003. These field activities included the installation of five (5) groundwater monitoring wells (MW-5, MW-6, MW-07D, MW-08D, MW-09D), the sampling of five these new monitoring wells and four (4) existing monitoring wells (L-2, L-3, MW-1 and MW-16), and the installation of five soil borings along the storm sewer (GP-41 through GP-45).

The third phase of field activities was conducted during April and June 2005. These field activities included the collection of two additional surface soil samples (HA-6 and HA-7) and collection of water at the outfall from a 12-inch clay pipe adjacent the river. This sampling event was followed by an attempt to conduct a camera survey of the 12-inch clay outfall pipe.

A camera survey was performed on 9 October 2003 to determine the condition of the storm sewer that runs through the CRS Site from Locust Street to the River. It was determined that the majority of the storm sewer is above the groundwater surface and it is a 15-inch vitrified clay pipe (VCP) pipe that is constructed in two-foot sections, and is approximately 325 feet in length. There were at least four perforations in the pipe (possible connections from former buildings and structures) and root intrusion. The pipe was in poor condition with numerous cracks. The last 30 to 35 feet of the storm sewer on the riverbank is full of water as it is broken.

At this time, the storm sewer line was traced and the position of the sewer pipe was marked on the surface of the CRS Site.

A summary of the perforations/cracks found within the sewer and a diagram indicating the locations of the perforations is included in the RI/FS Report Revision 3, Appendix H, 2006.

On 23 June 2005, a television/video inspection of the 12-inch clay pipe that outlets at the river bank at the south end of the CRS Site was conducted. This is the pipe that a sample was collected from in April 2005. The inspection equipment was only able to proceed 18 feet into the sewer from the outfall before obstructions prevented further movement. The camera was able to see into the sewer approximately an additional six feet

2.5.8 Known and or Suspected Sources of Contamination

Suspected sources of contamination include on-site receipt, storage and processing of solvents utilized in the reclamation/distillation process. It appears that wastes were deposited into soil and groundwater from where the former five drum storage areas were located, and in the NW corner of the CRS Site where the former tank farm was located. Another source of contamination is from where the two former still buildings stood.

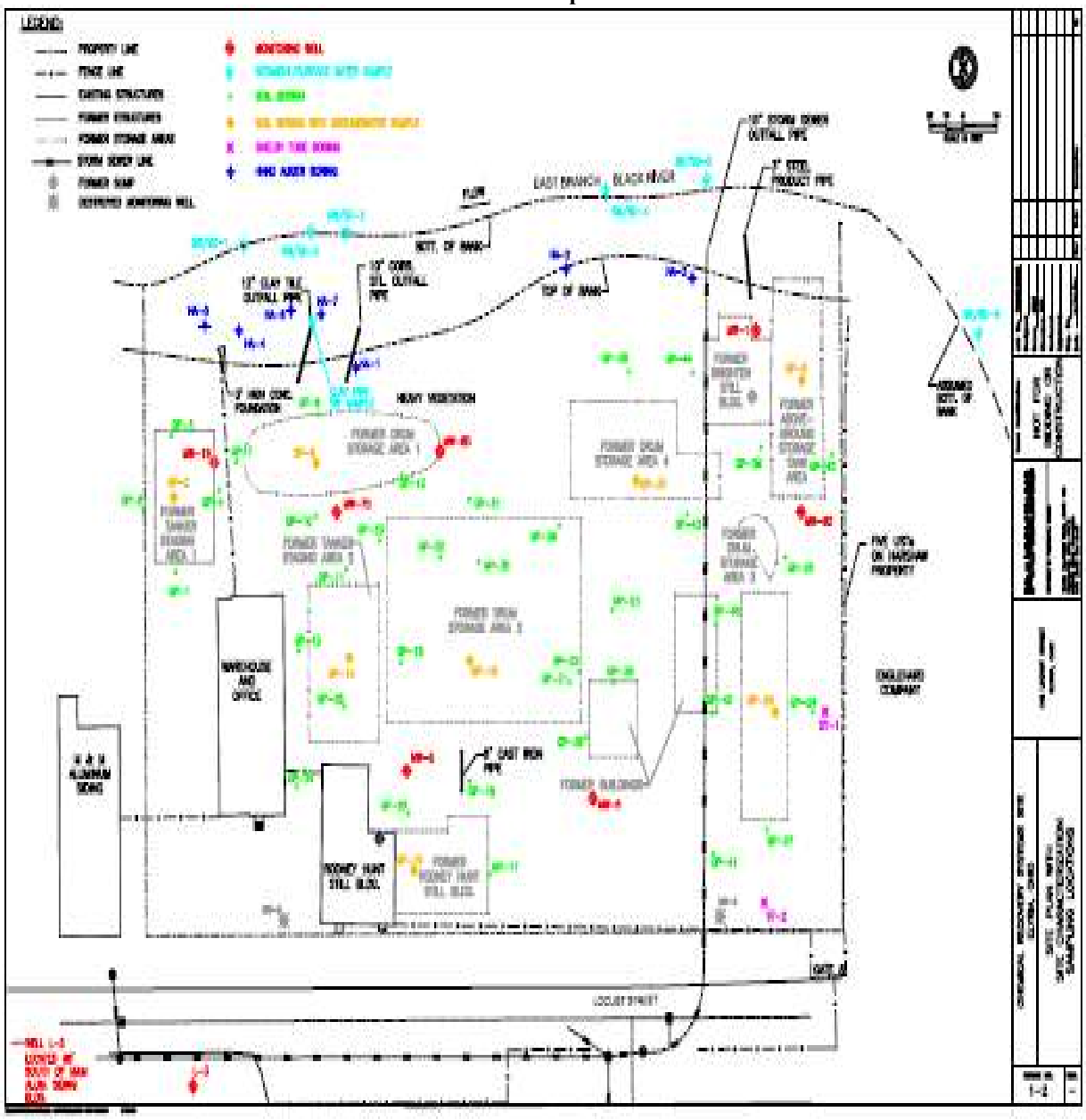
Boring locations were also determined in the field using high-resolution aerial photographs with a known scale. Based on the aerial photograph, boring locations were scaled off using permanent on-site structures (buildings, foundations, railroad tracks, etc.). During the CRS Site investigation, a stake with the boring identification number was placed at all boring locations (including temporary monitoring wells). After all field activities were completed, the boring locations, temporary monitoring wells, and permanent monitoring wells were professionally surveyed (Figure 1-2).

2.5.9 Types of Contamination and Affected Media

Operations at the CRS Site have resulted in the discharge of contaminants to the vadose zone and the underlying groundwater. Although a variety of chemicals have been released, VOCs are the primary chemical found in both the vadose zone and groundwater. VOCs and non-VOCs have been found in the vadose zone. The RI studies identified the following hazardous substances in soil:

- Tetrachloroethene (PCE, a cleaning solvent)
- Trichloroethene (TCE, a cleaning solvent, and a by product of PCE)
- Dichloroethene (DCE, a by-product of TCE)
- Dichloroethane (DCA, a by product of DCE)
- Vinyl Chloride (a by product of DCA)
- Benzene, Toluene, Ethylbenzene, (total) Xylene (BTEX)
- Polychlorinated biphenyls (PCBs)
- Polyaromatic hydrocarbons (PAHs)
- Metals

Figure 1-2
CRS Site Sample Locations



2.5.9.1 Soil

Fifty soil samples were collected and analyzed for VOCs, SVOCs, PCBs, and metals. VOCs detected above action levels were predominately chlorinated hydrocarbons or solvents such as: PCE, TCE, 1,2- Dichloroethane 1.2-DCA, Vinyl Chloride, BTEX, and Chloroform.

These chemicals were detected in soil throughout the CRS Site with the highest concentrations co-located in the NW corner, at the zero to four feet (0 - 4') depth. Health risks associated with these chemicals to the future industrial worker are unacceptable under soil ingestion, inhalation and dermal contact exposure pathways. In general, the concentrations of VOCs decreased with soil depth. Chemicals detected at the four feet to eight feet interval include PCE, TCE, Ethylbenzene, and Xylene. Chemicals detected between eight feet and 16 feet were, for the most part, not above the site-specific risk level (Figures 4-1 through Figure 4-10).

The following five SVOCs were detected in soil above health-based risk levels to the future industrial worker (outdoor): Benzo (a) anthracene, Benzo (b) fluoranthene, Benzo (a) pyrene, and Dibenzo (a, h) anthracene, and Indeno (1,2,3-c,d) pyrene. As with the VOCs, the SVOC concentrations also decreased with depth.

Arsenic was the only metal COC that contributed to the site-specific risk for the future industrial worker (outdoor). Polychlorinated biphenyls (PCBs) that contribute to the site-specific risk to the future industrial outdoor worker include Aroclor-1242, Arcolor-1248, Aroclor-1254, and Aroclor-1260. Except for one sample, PCBs in soil above the site-specific risk level for direct contact exposure were detected at depths greater than four feet.

Figure 4-1
VOCs in Unconsolidated Material (0-4' Interval)

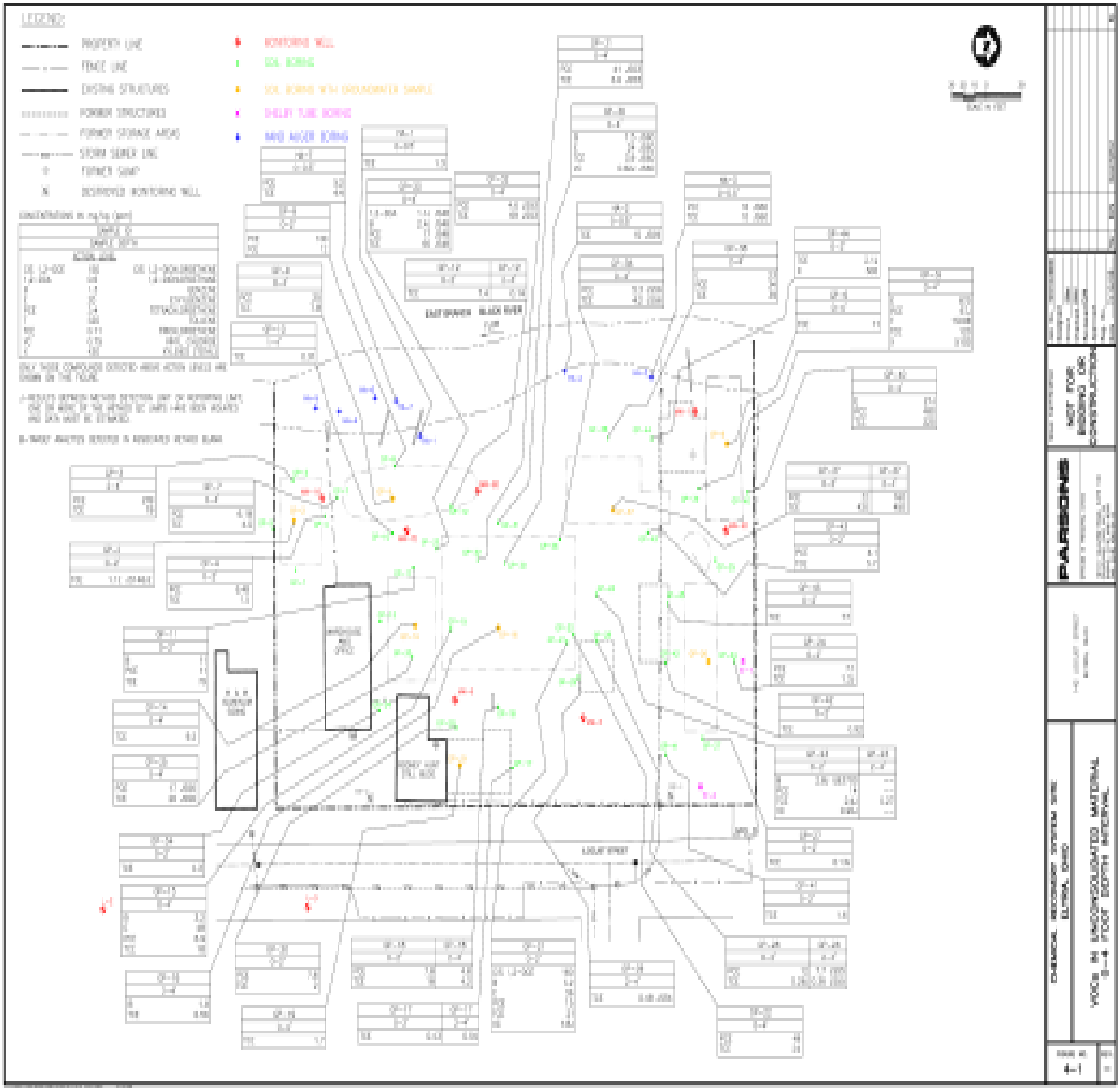


Table 4-A Chemical of Concern in Soil

Compound	Highest Concentration mg/kg
Volatile Organic Compounds	
Benzene	11 @ GP-11 (0-2')
Ethylbenzene	870 @ GP-39 (0-4')
PCE	480 @ GP- 40 (0-4')
TCE	450 @ GP- 37 (0-4')
Xylenes (total)	5100 @ GP-39 (0-4')
Semi-Volatile Organic Compounds	
Benzo(a)anthracene	39J @ GP-34 (0-2')
Benzo(a)pyrene	36 @ GP-12 (0-2')
Benzo(k)fluoranthene	25 @ GP-12 (0-2')
Dibenzo(a,h)anthracene	8.1 @ GP-12 (0-2')
Indeno(1,2,3-cd)pyrene	29 @ GP-12 (-12')
TAL Metals	
Antimony	1750J @ GP-38 (12-38')
Arsenic	228 @ GP-38 (12-15')
Iron	19,000 @ GP-6 (12-16')
Lead	3,380 @ GP-38 (8-12')
Polychlorinated Biphenyls	
Aroclors 1221	1.9 @ GP-45 (0-2')
Aroclors 1242	79 @ GP-41 (0-2')
Aroclors 1248	7 @ GP-15 (0-4')
Aroclors 1254	65 @ GP-44 (0-2')
Aroclors 1260	2.7 @HA-2 & GP-15 (0-4')

Notes:
<or U - Compound detected below the method detection Limit (MDL) at a given concentration.
J (organic) – Results between MDL and reporting limit (RL); data may be estimated.
J (inorganic) – Target analytes detected in the associated Method Blank.
B (organic) - Target analytes detected in the associated Method Blank.
B (inorganic) - Results between MDL or RL; data may be estimated.
* MDL is greater than the action levels.

Figure 4-2
VOCs in Unconsolidated Material (4-8' Interval)

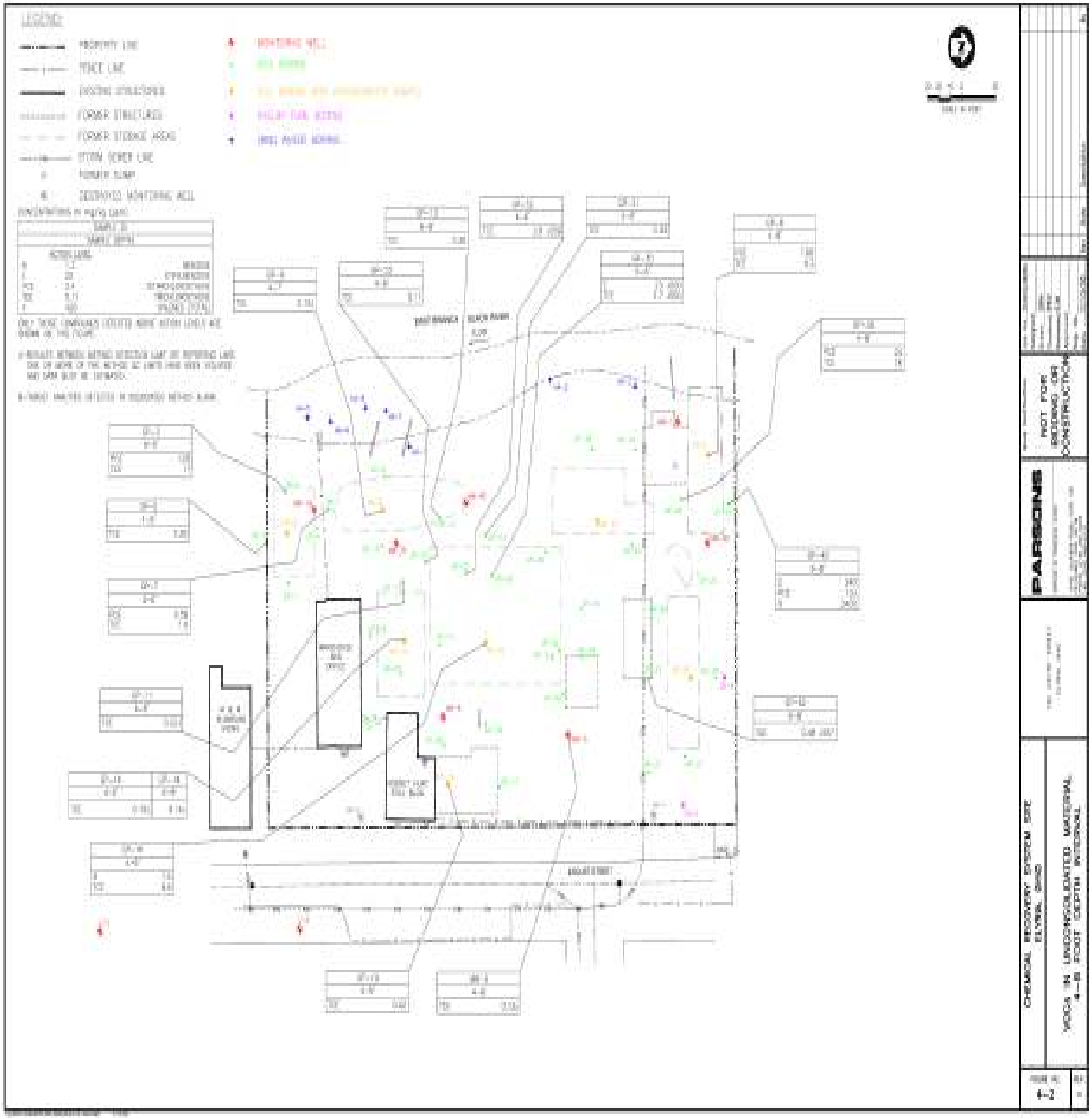


Figure 4-3

VOCs in Unconsolidated Material (>8' and <16' Interval)

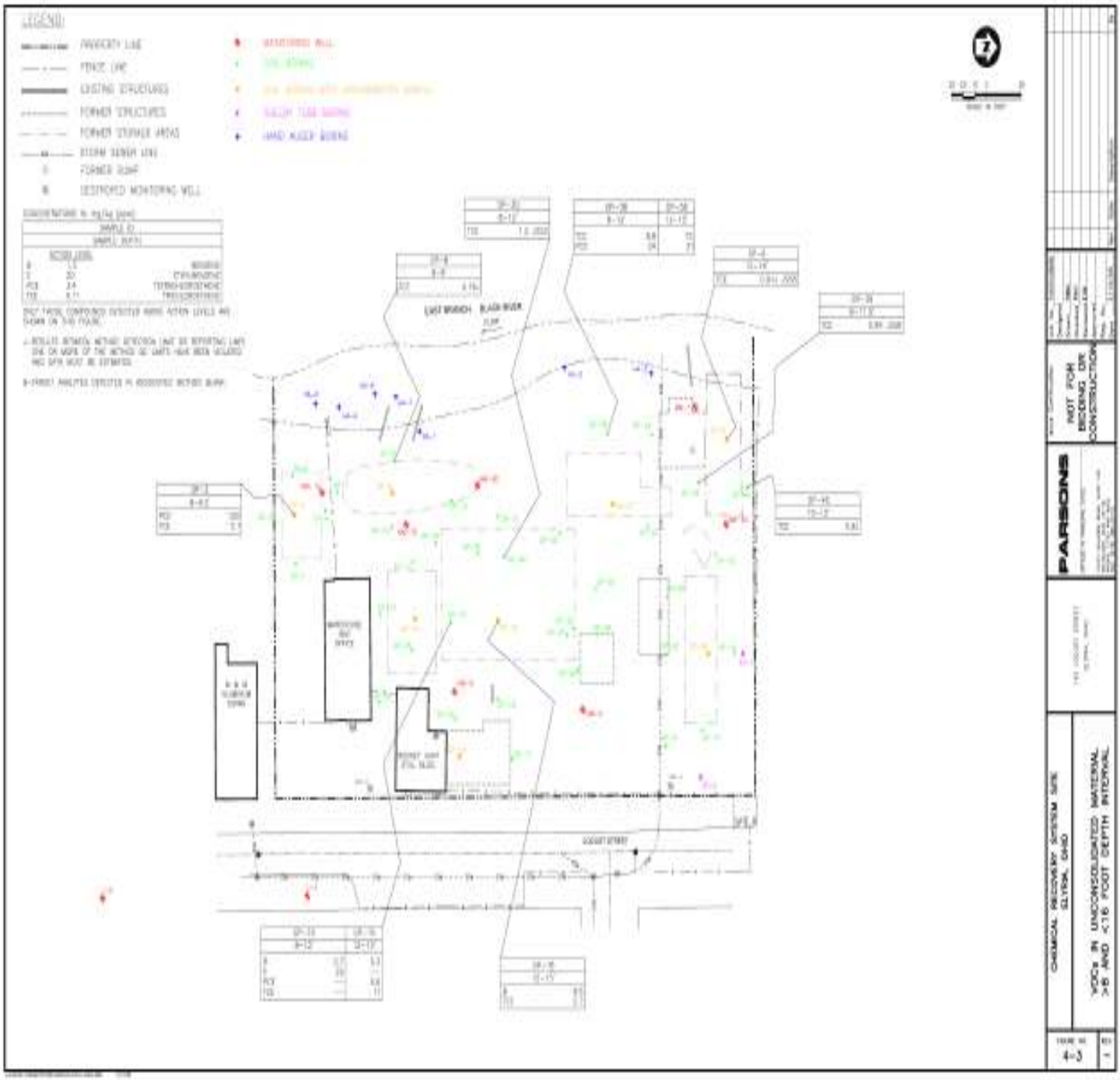


Figure 4-4

SVOCs in Unconsolidated Material (0-4' Interval)

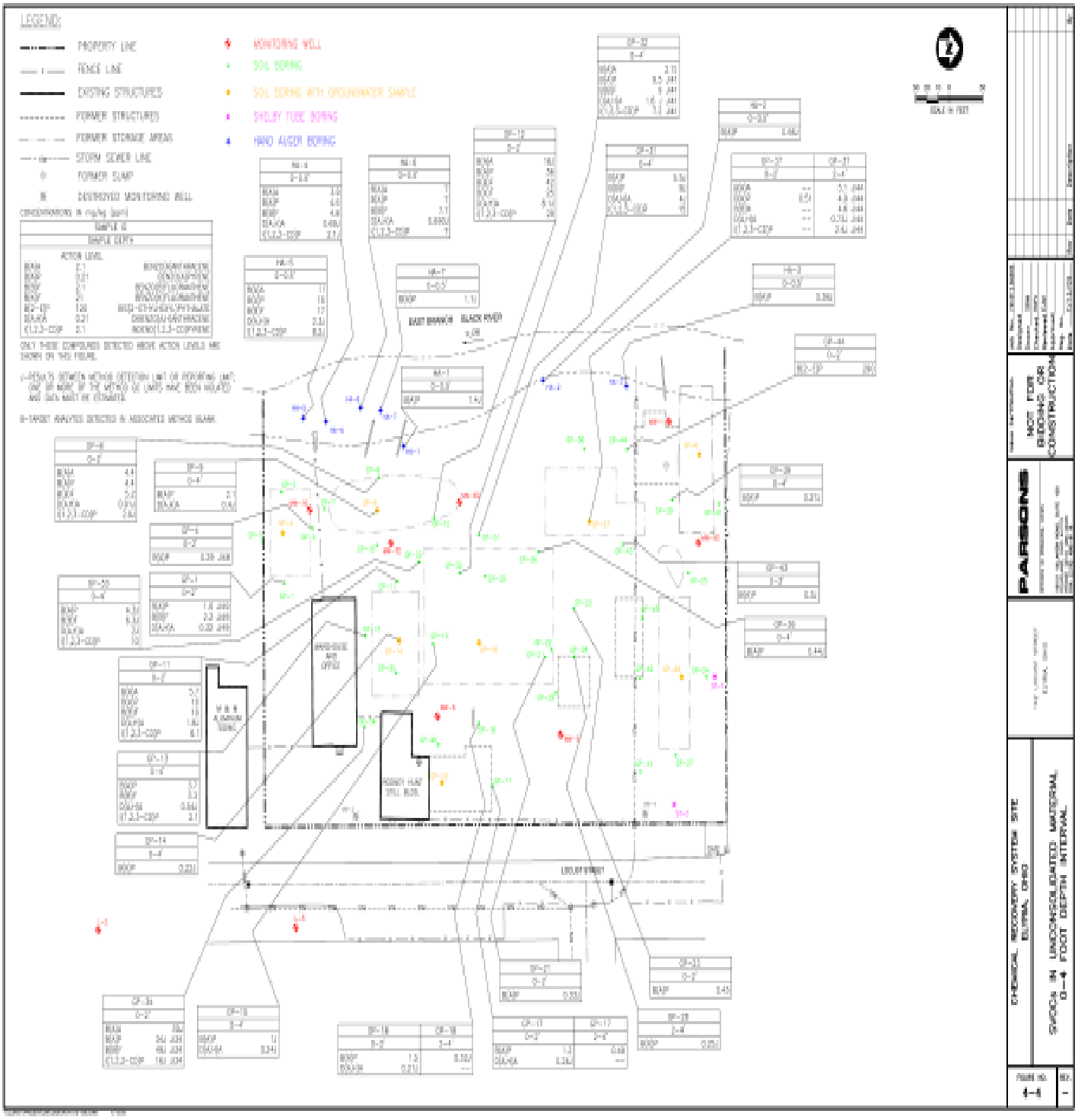


Figure 4-5

SVOCs in Unconsolidated Material (4'-8' Interval)

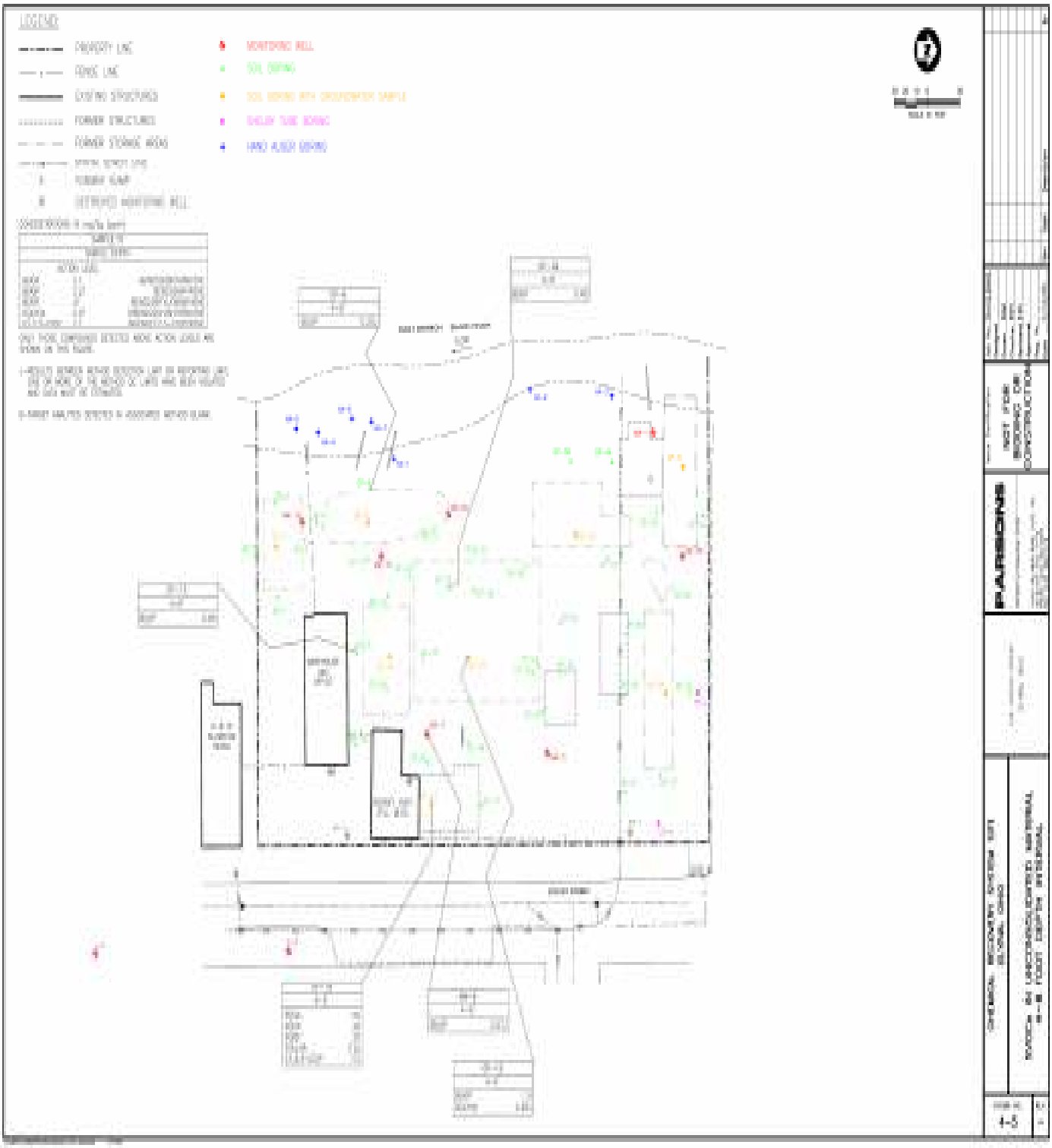


Figure 4-6

SVOCs in Unconsolidated Material (>8' and < 16' Interval)

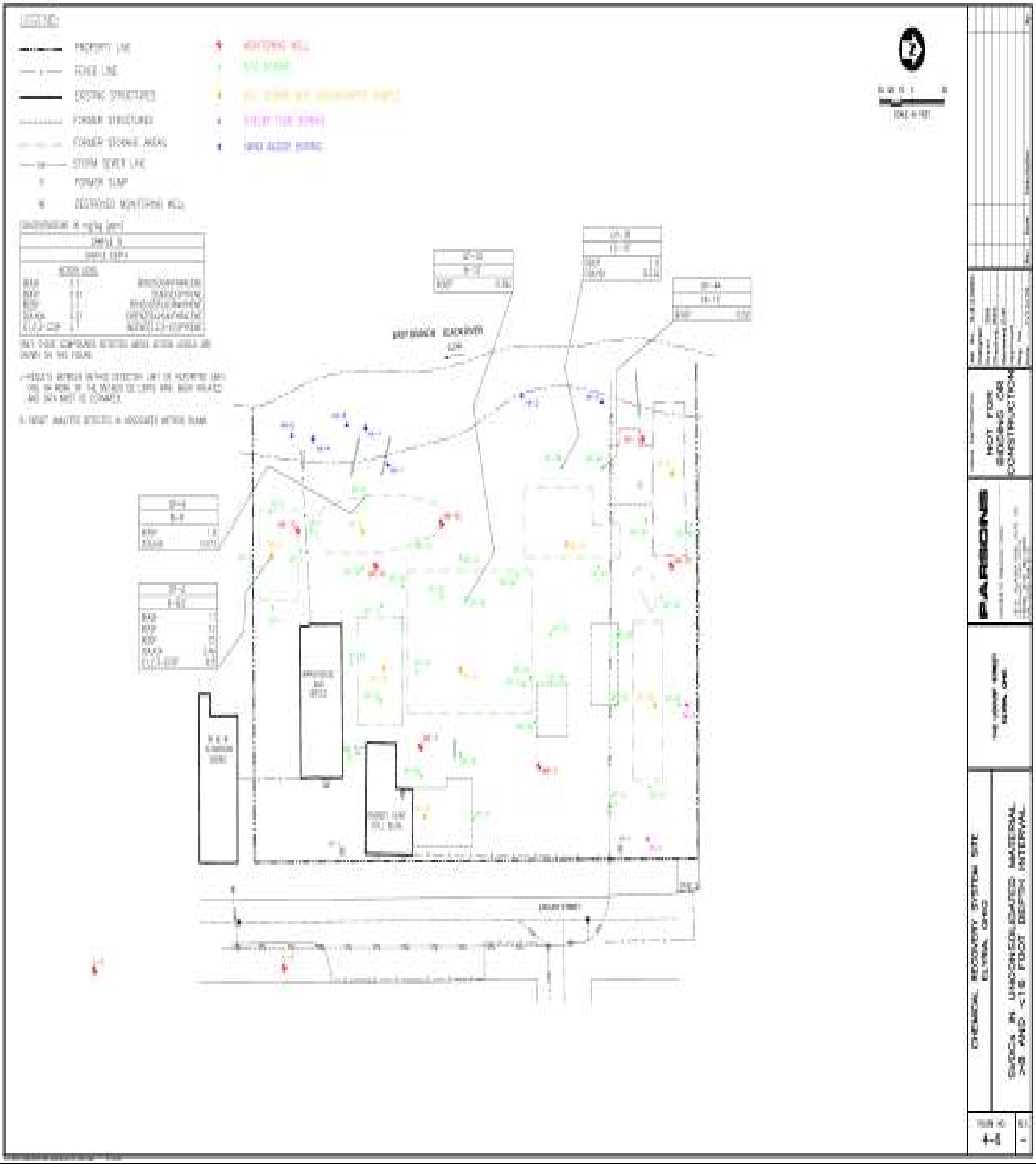


Figure 4-7

Metals in Unconsolidated Material (0 to 4' Interval)

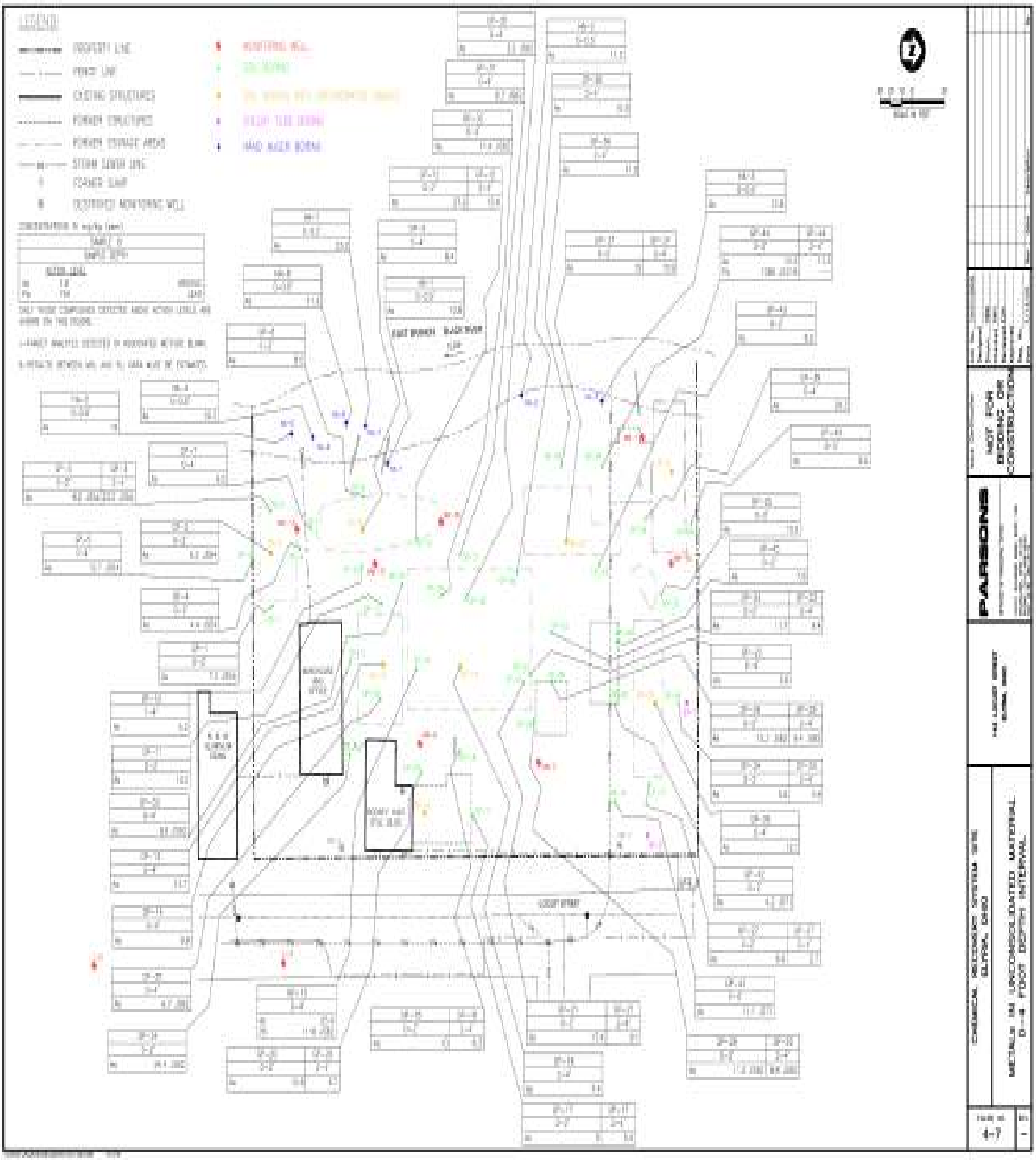


Figure 4-8

Metals in Unconsolidated Material (4 to 8' Interval)

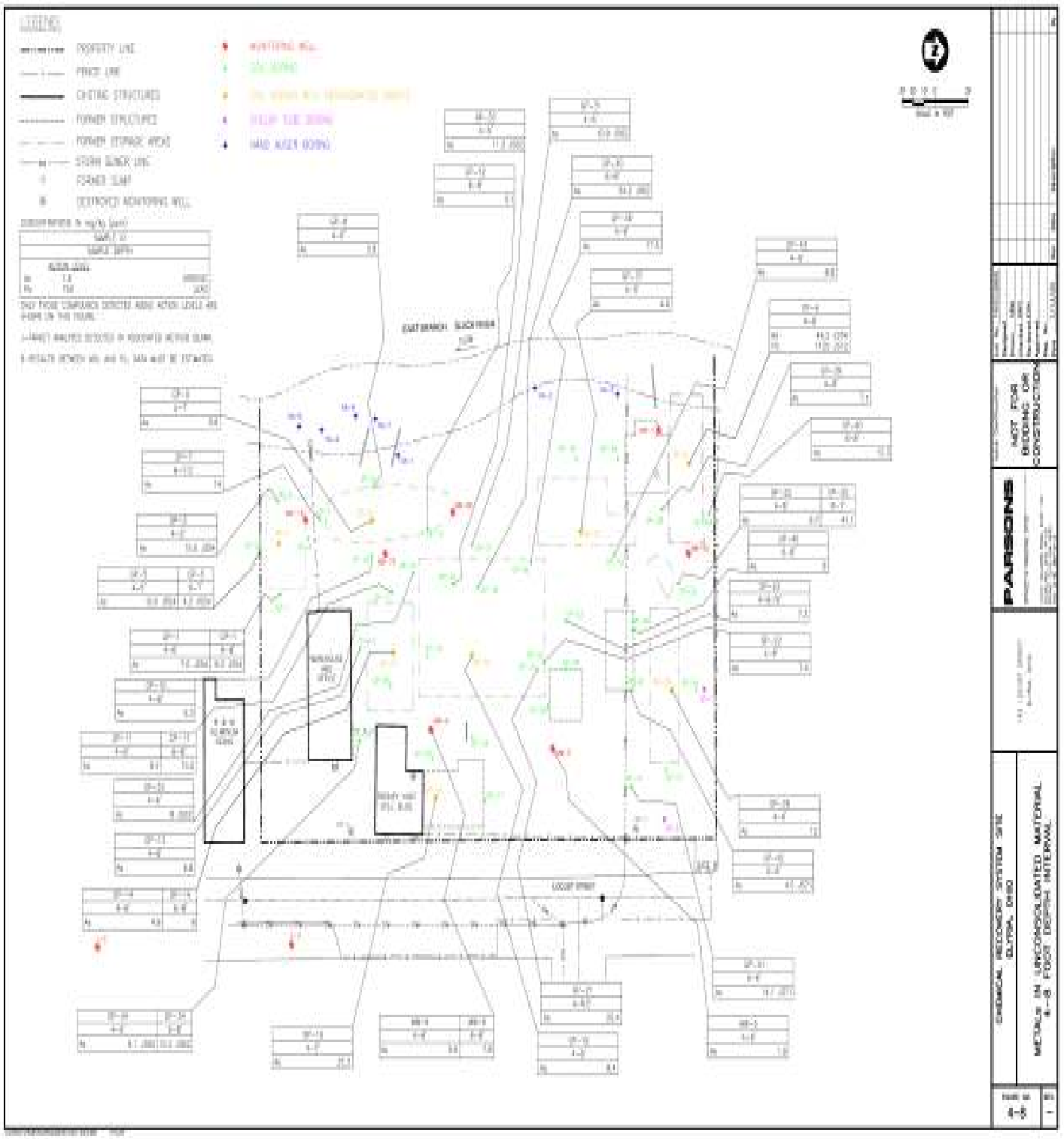


Figure 4-9

Metals in Unconsolidated Material (>8 and <16'' Interval)

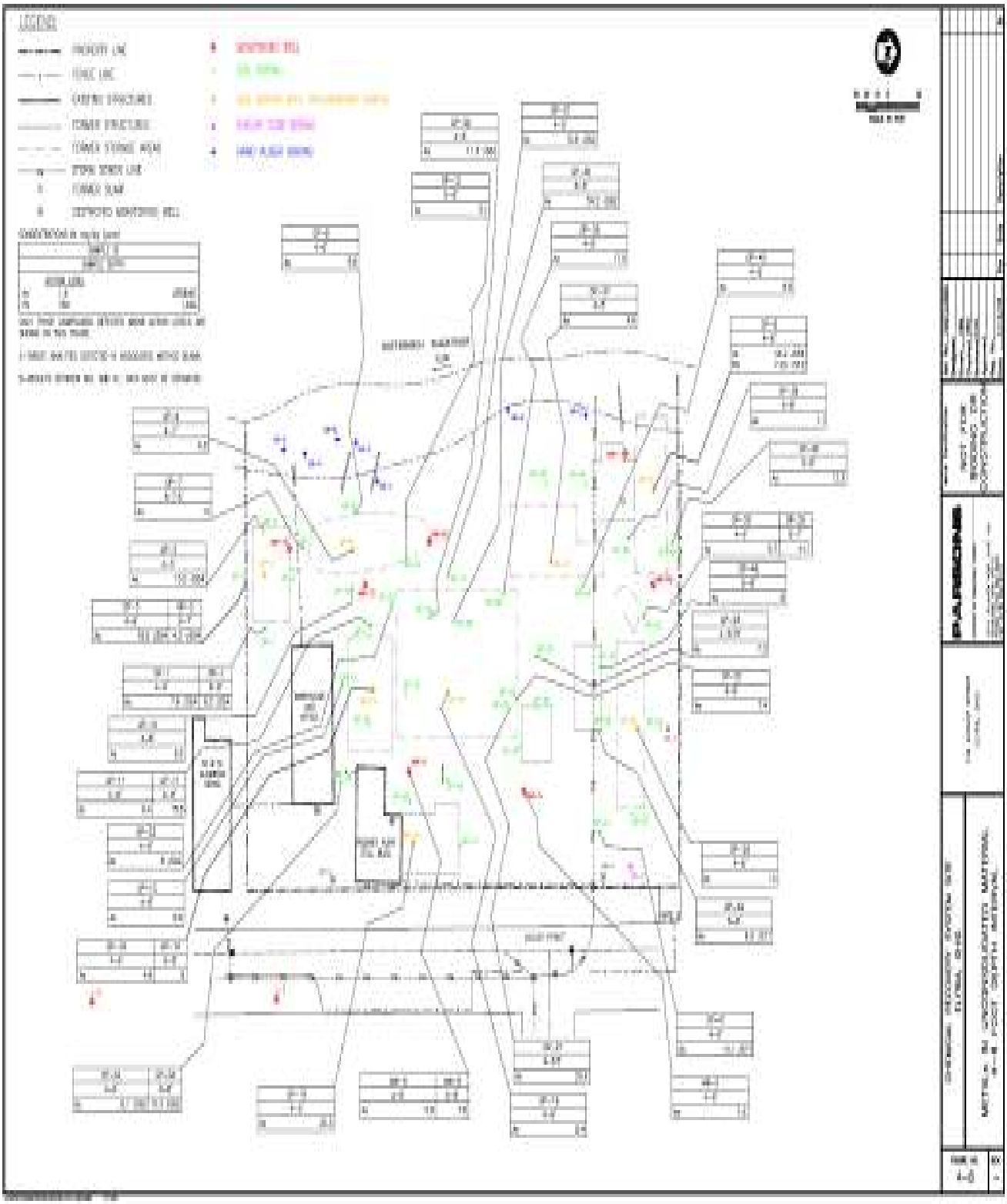


Figure 4-10

PCBs in Unconsolidated Material

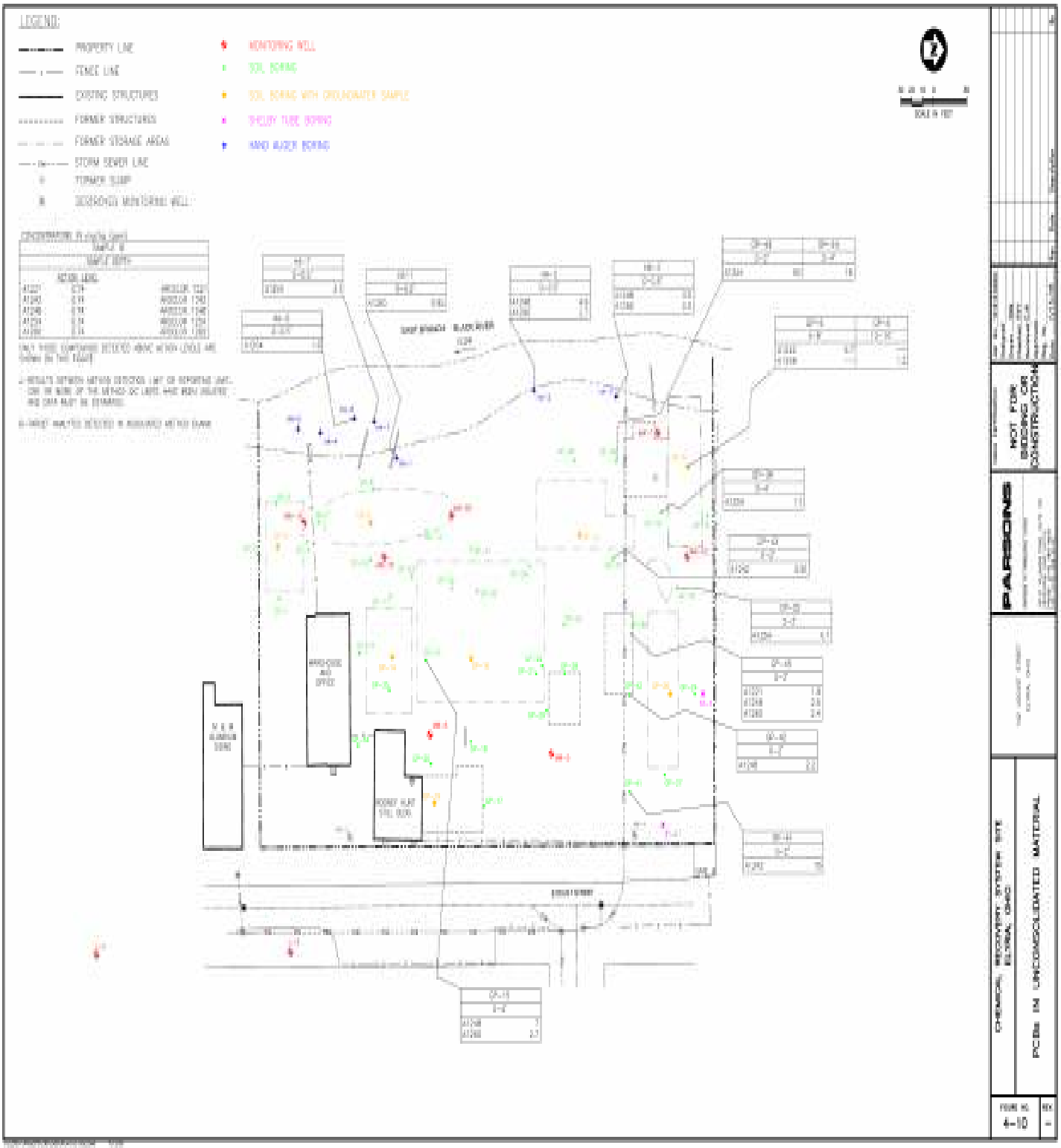


Figure 4-11

VOCs in Groundwater

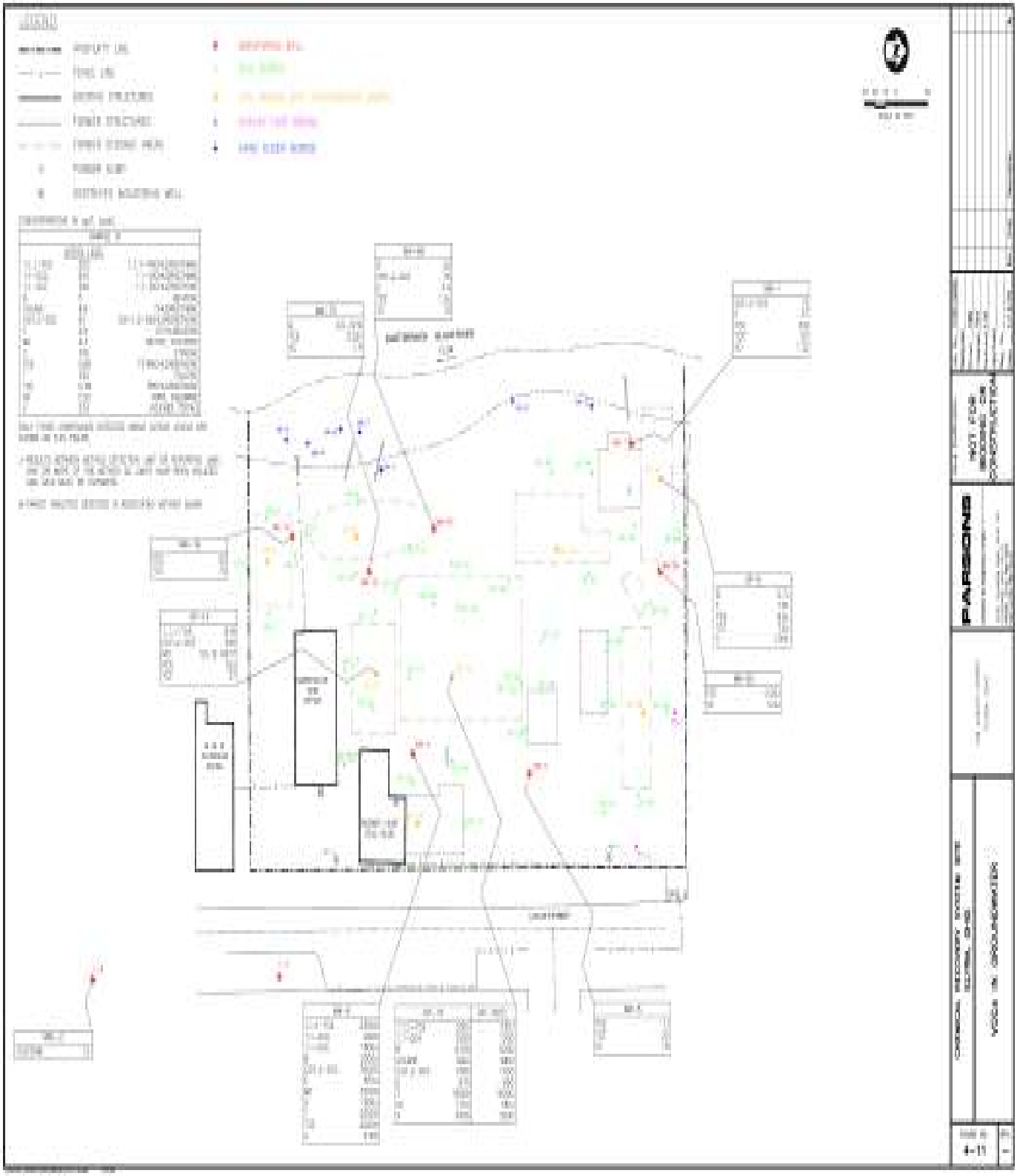


Figure 4-12

VOCs in Groundwater (Unconsolidated Material and Shallow Bedrock Isoconcentration Map)

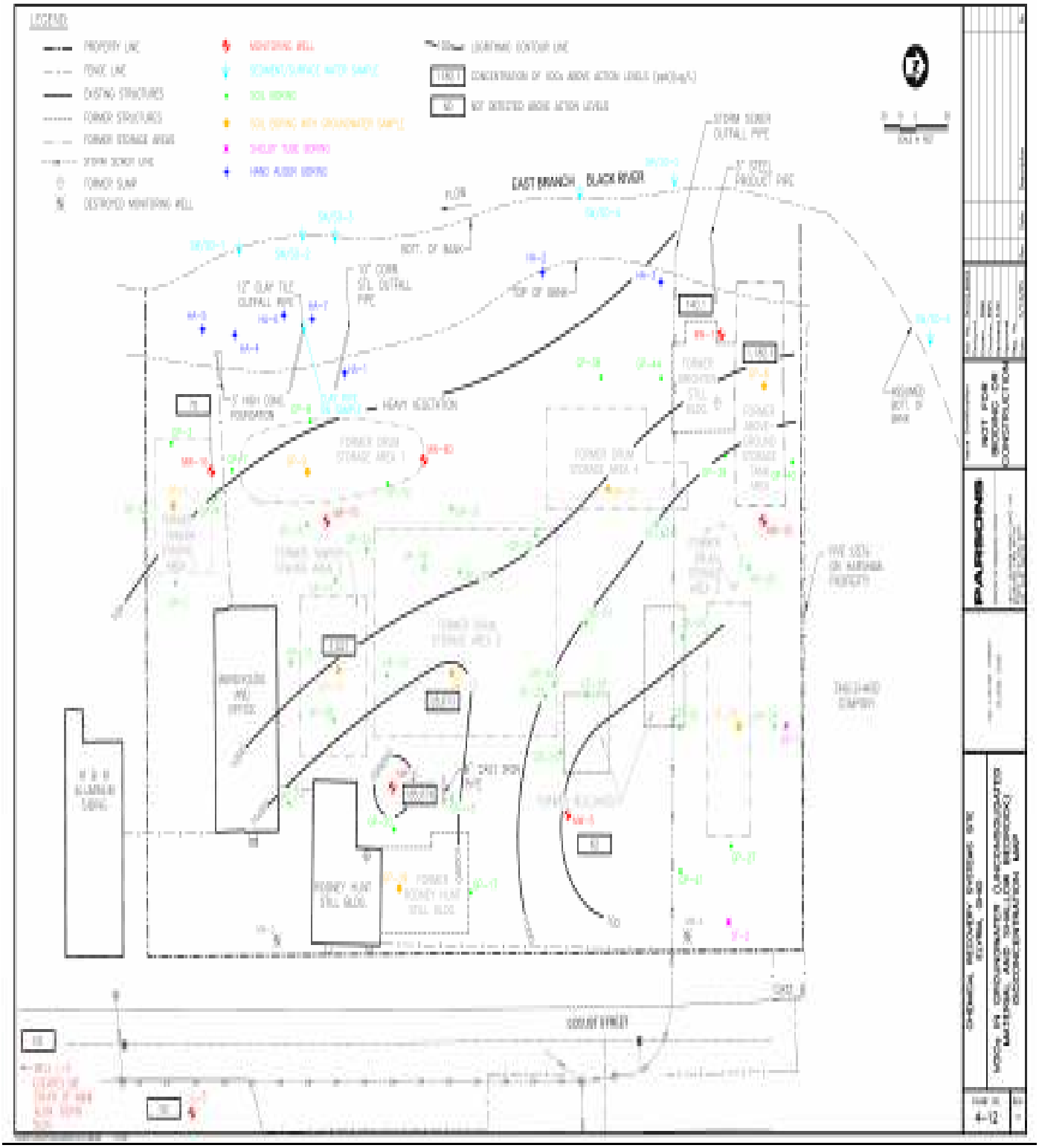


Figure 4-13

VOCs in Groundwater (Intermediate Bedrock Isoconcentration Map)

Figure 4-14

SVOCs in Groundwater

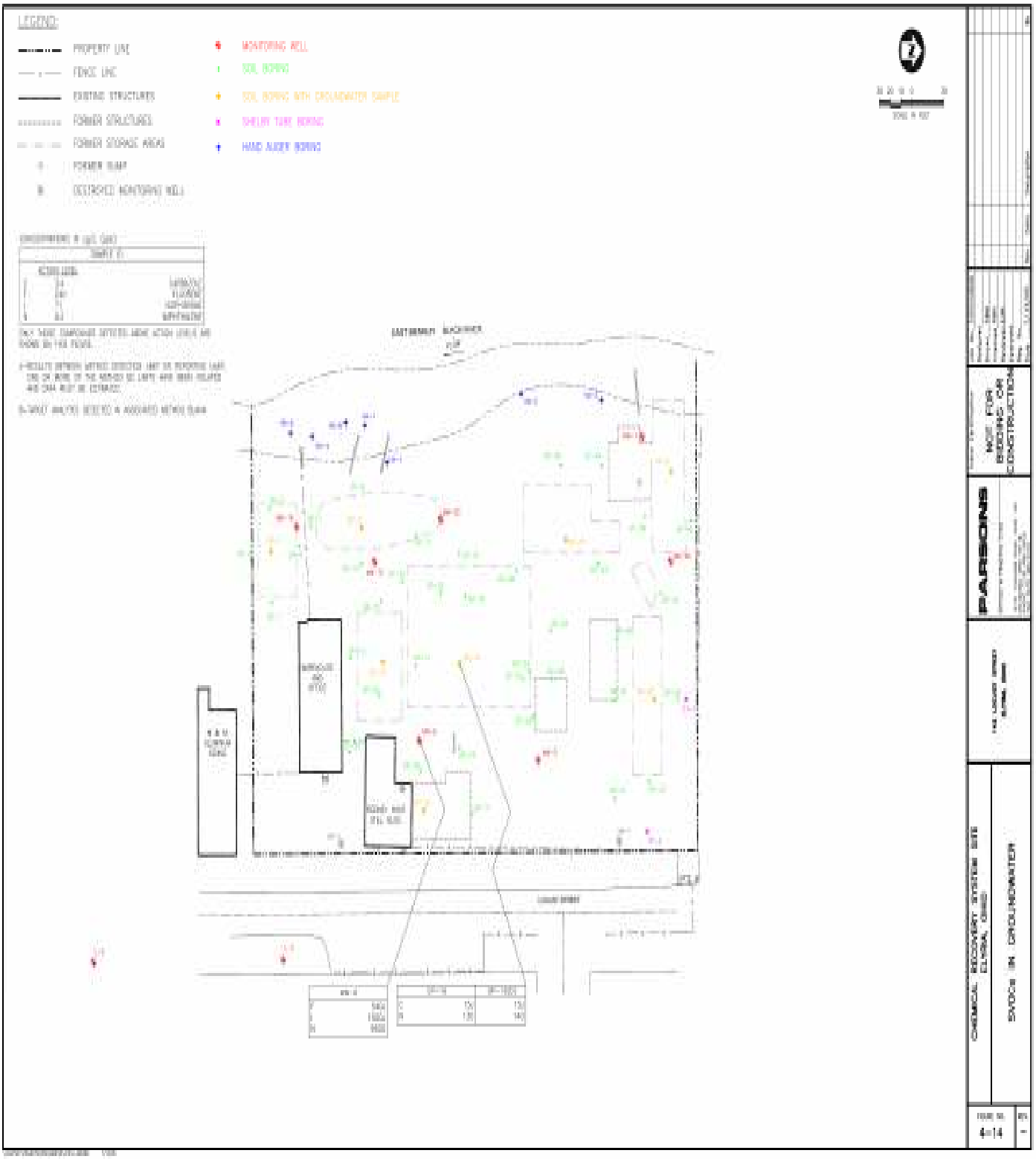


Figure 4-15

Metals in Groundwater

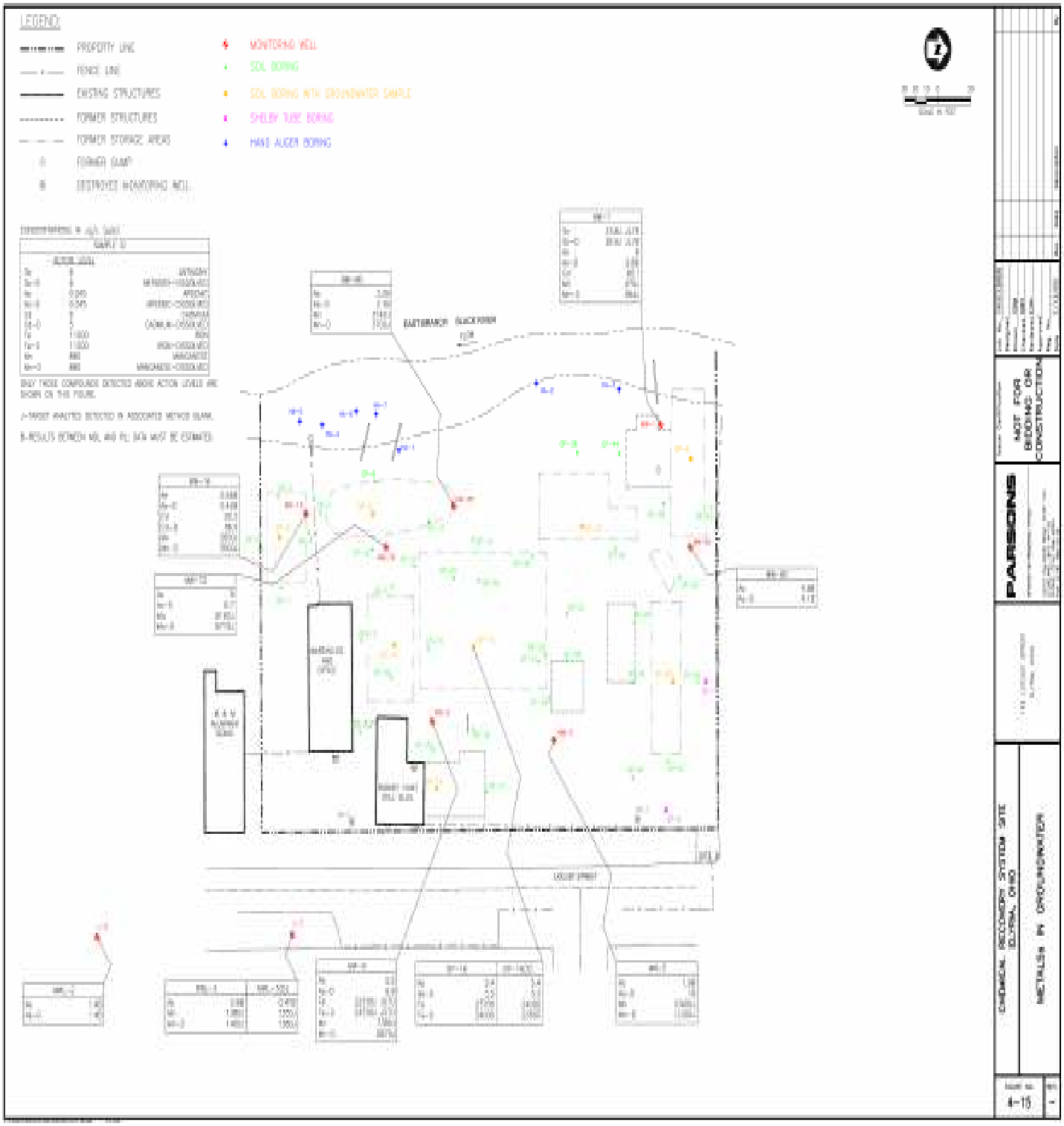


Figure 4-16

Dissolved Arsenic in Groundwater (Unconsolidated Material and Shallow Bedrock Isoconcentration Map)

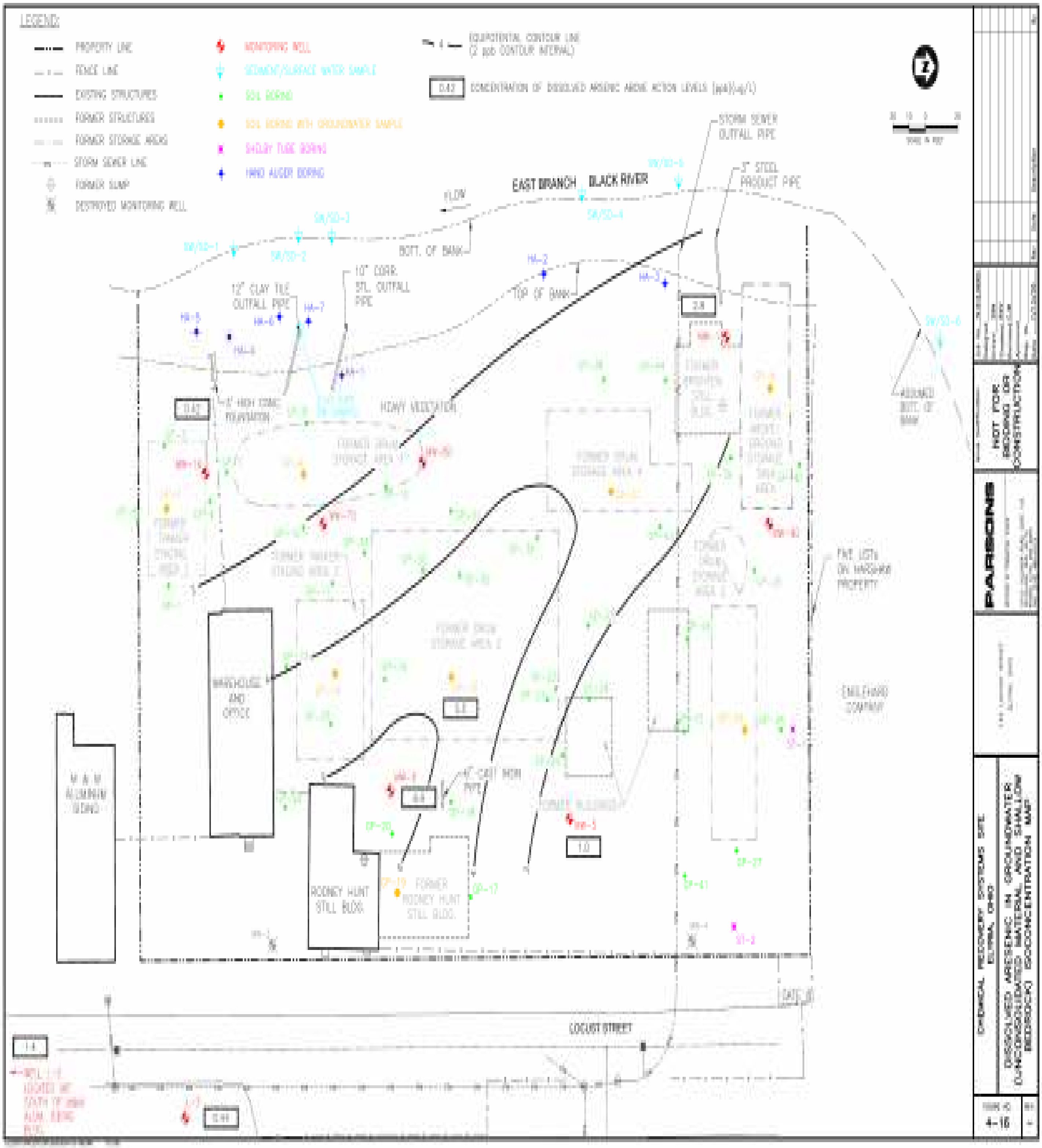


Figure 4-17

Dissolved Arsenic in Groundwater (Intermediate Bedrock Isoconcentration Map)

Table 4-B Chemicals of Concern in Groundwater

Compound	MCLs	Highest Concentration µg/L
Volatile Organic Compounds		
1,1,1-Trichloroethane	200	23,000 MW-6
1,1-Dichloroethane	-	4,000 MW-6
1,1-Dichloroethene	7	1,800J MW-6
Benzene	5	1,600 GP-16 Duplicate
0.5 Chloroethane	-	300J GP-16
Chloroform	-	13 MW L-2
Cis-1,2-chloroethene	70	7,600 MW-6
Ethylbenzene	700	970 MW-6
Methylene Chloride	-	33,000 MW-6
PCE	5	55 GP-16
Styrene	-	1,600J MW-6
TCE	2	20,000 MW-6
Toluene	1000	20,000 MW-6
Vinyl Chloride	2	180J GP-16 Duplicate
Xylenes (total)	10000	3,300 GP-16
Semi-Volatile Organic Compounds		
Fluorene	-	540J MW-6
Isophorone	-	15,000J MW-6
Naphthalene	-	9,600 MW-6
Antimony	6	33.8J JL 78 MW-1
TAL Metals		
Antimony Dissolved	6	36.9J JL 78 MW-1
Arsenic	10	9 MW-7D
Arsenic Dissolved	10	8.7 MW-7D
Cadmium	5	92.2 MW-16
Cadmium Dissolved	5	89.9 MW-16
Iron	-	24,000 GP-16
Iron Dissolved	-	23,600 GP-16
Lead	15	2.7 GP-16
Lead Dissolved	15	0.099BJUB MW-6
Manganese	-	10,400J MW-5
Manganese Dissolved	-	12,300 MW-5
Polychlorinated Biphenyls		
Aroclors 1016	0.5	1U JS44 MW-6
Aroclors 1016 Dissolved	0.5	1U JS 19 MW-6
Aroclors 1221	0.5	1U JS44 MW-6
Aroclors 1221 Dissolved	0.5	1U JS 19 MW-6
Aroclors 1232	0.5	1U JS44 MW-6
Aroclors 1232 Dissolved	0.5	1U JS 19 MW-6
Aroclors 1242	0.5	1U JS44 MW-6
Aroclors 1242 Dissolved	0.5	1U JS 19 MW-6
Aroclors 1248	0.5	1U JS44 MW-6
Aroclors 1248 Dissolved	0.5	1U JS 19 MW-6
Aroclors 1254	0.5	1U JS44 MW-6
Aroclors 1254 Dissolved	0.5	1U JS 19 MW-6
Aroclors 1260	0.5	1U JS44 MW-6
Aroclors 1260 Dissolved	0.5	1U JS 19 MW-6

Notes:
< or U - Compound detected below the method detection Limit (MDL) at a given concentration.
J (organic) - Results between MDL and reporting limit (RL); data may be estimated.
J (inorganic) - Target analytes detected in the associated Method Blank.
B (organic) - Target analytes detected in the associated Method Blank.
B (inorganic) - Results between MDL or RL; data may be estimated.
-- - No MCL/PRG available for that parameter.

Figure 4-18

VOCs and SVOCs in Surface Water

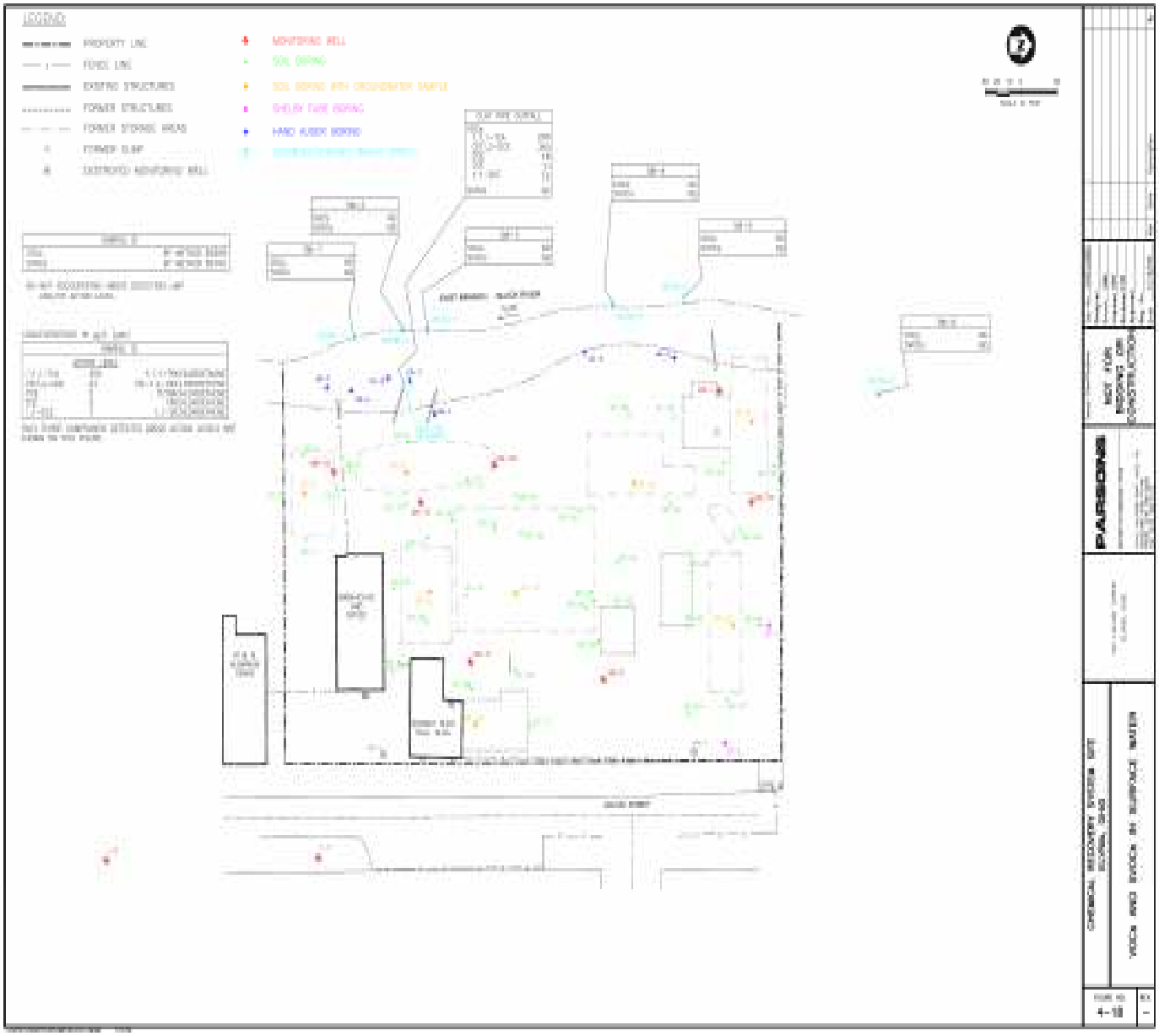


Figure 4-19

PCBs Surface Water (All Non-Detects)

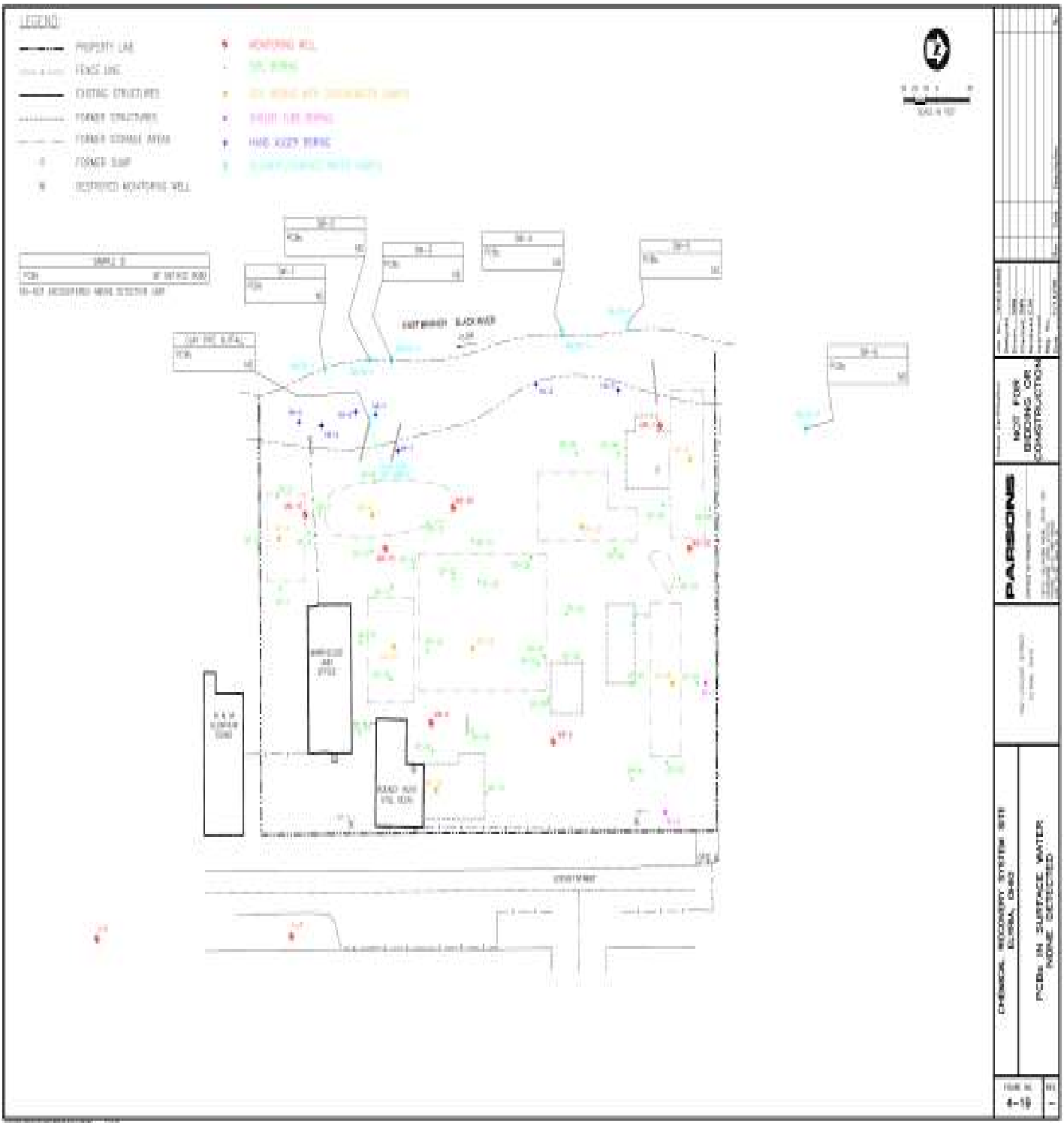


Figure 4-20

Metals in Surface Water

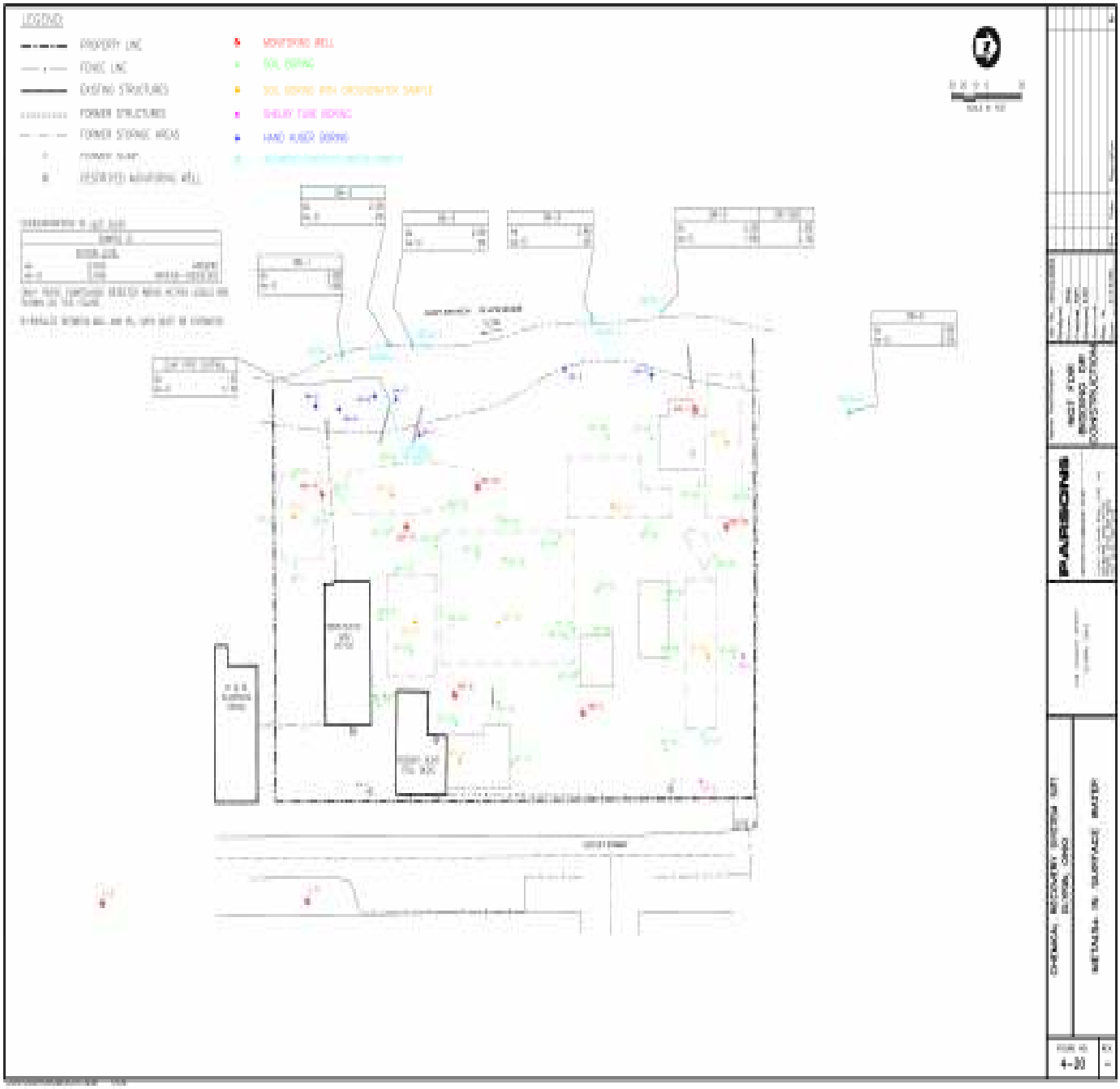


Figure 4-21

VOCs in Sediments (All Non Detects)

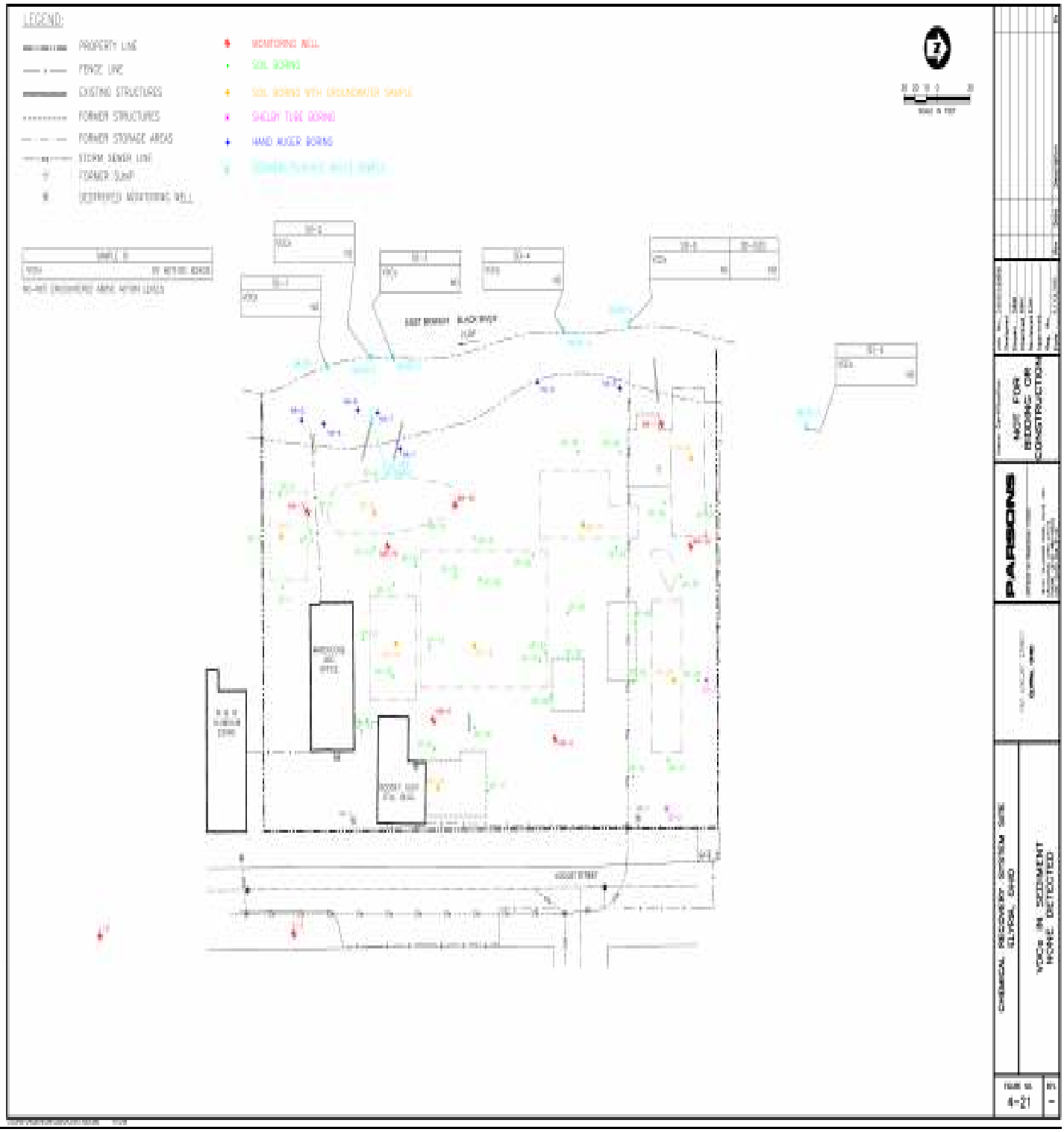


Figure 4-22

PCBs in Sediments (All Non Detects)

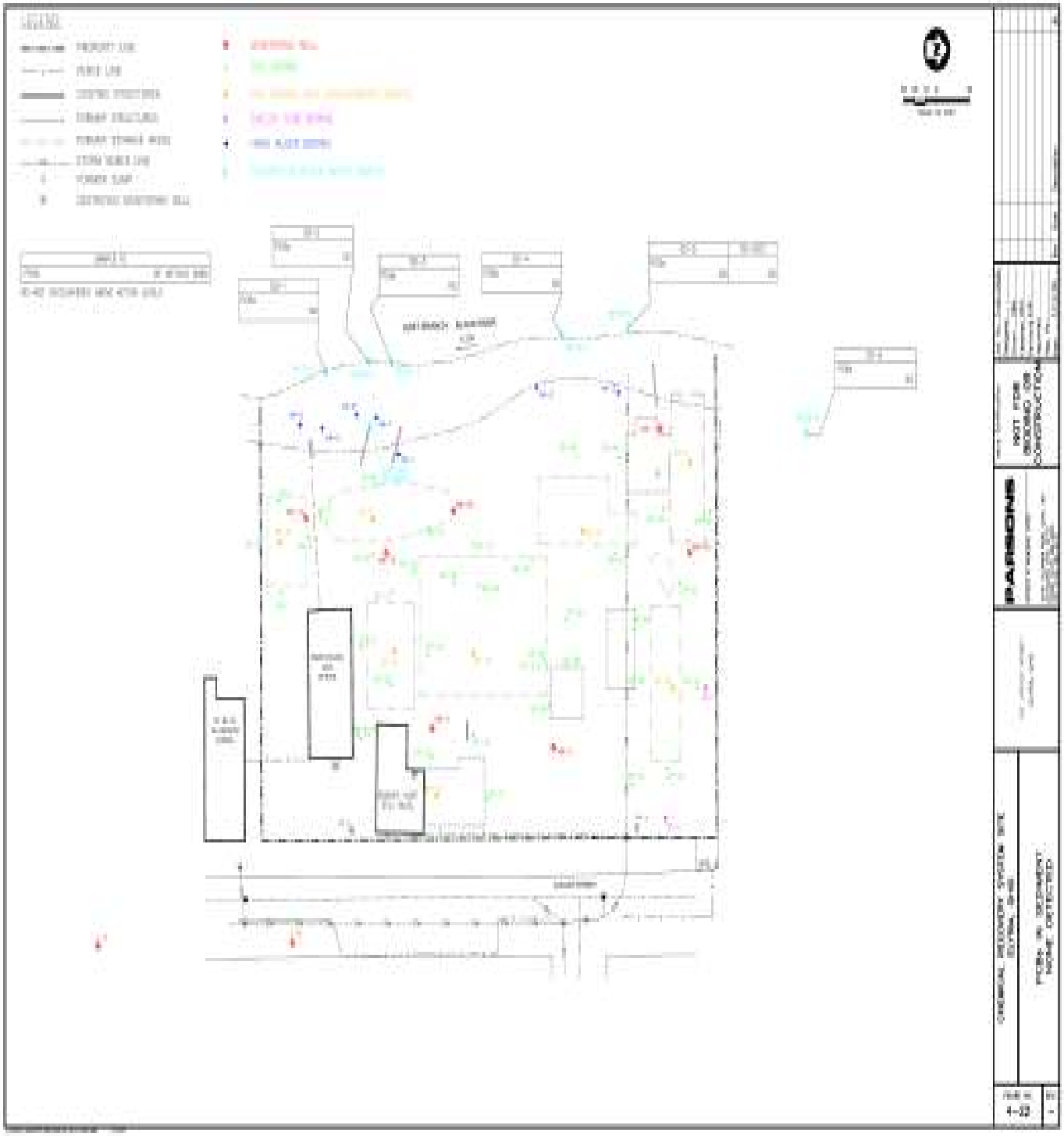
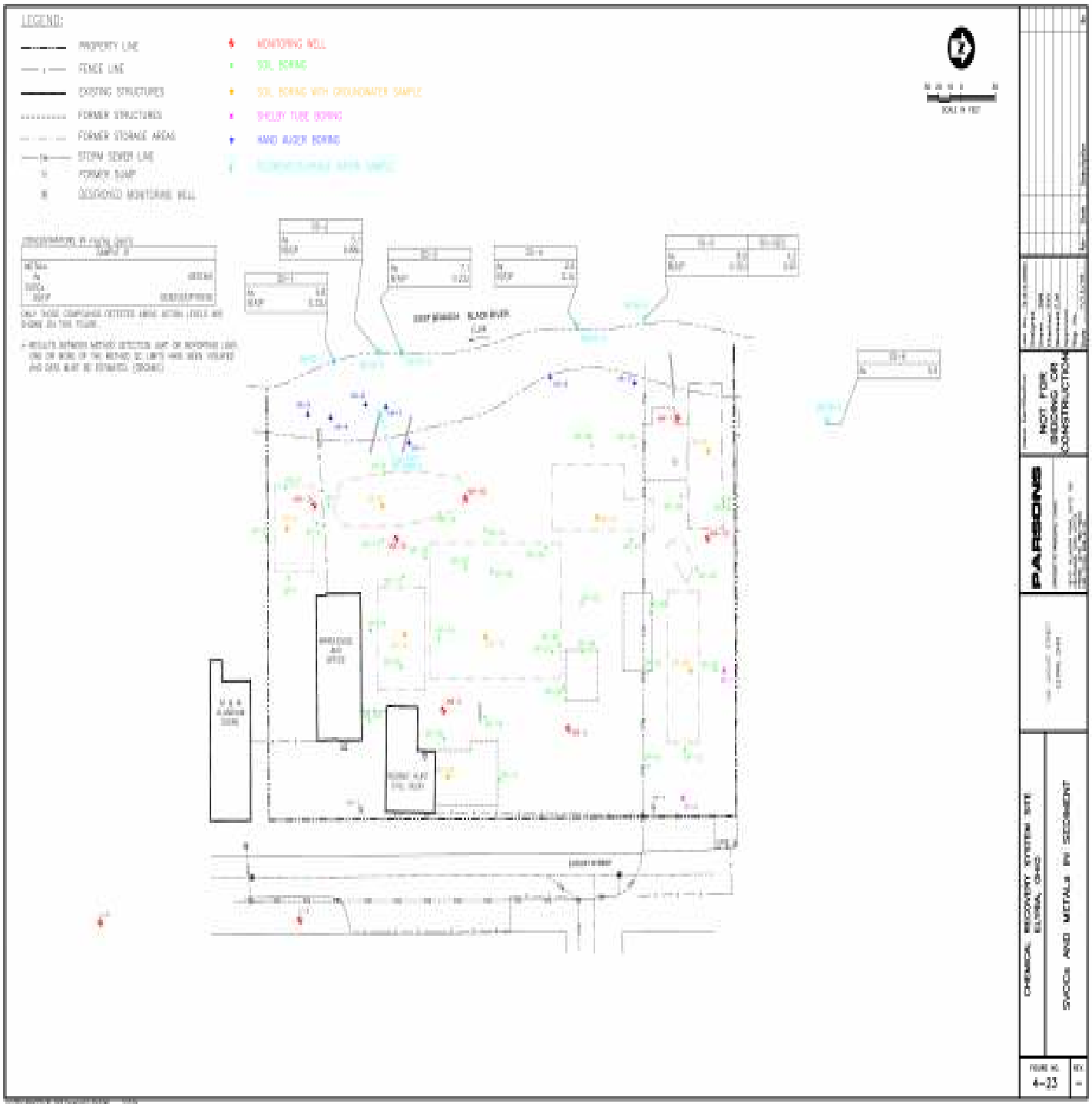


Figure 4-23

SVOCs and Metals in Sediment



2.5.9.2 Sediment

Six sediment samples were collected from the River and analyzed for VOCs, SVOCs, PCBs, and metals. VOCs and PCBs were not detected in any sediment samples collected. The SVOC, Benzo (a) pyrene, was detected in all sediment samples except from one upstream location. Arsenic is the only metal detected above the Preliminary Remediation Goals (PRGs) in all sediment samples, including the upstream (Figures 4-21 through 4-23).

2.5.9.3 Surface Water

Six surface water samples were collected from the River and analyzed for VOCs, SVOCs, metals, and PCBs. VOCs, SVOCs, and PCBs were not detected in any surface water samples collected. Arsenic (total and dissolved) was detected above action level (0.045 ppb) but not above the water quality standards (3.0 ppb) in all surface water samples. The upstream/background sample for arsenic was greater than or equal to the downstream (CRS Site related) samples (Figures 4-18 through 4-20).

2.5.9.4 Groundwater

Groundwater samples were collected and analyzed for VOCs, SVOCs, metals, and PCBs. VOCs detected above the site specific health risk level to the future industrial worker (outdoor) and greater than the maximum contaminant levels (MCLs) for drinking water include: 1,2-DCA, 1,1-DCA, 1,1-Dichloroethene (DCE), Acetone, Chloroethane, Chloroform, Cis-1,2-DCE, Ethyl-benzene, Methylene Chloride, PCE, Styrene, Toluene, TCE, Vinyl Chloride, and Xylene. Review of historical groundwater analytical results (field and laboratory), and from the most impacted groundwater monitoring well (MW – 6), located near the former Rodney Hunt Still Building), suggest that the VOCs are naturally degrading. This conclusion was reached after evaluating the CRS Site conditions, including concentrations or readings of key analytes compared to established screening criteria for monitored natural attenuation (MNA). Such parameters include dissolved oxygen, ferrous iron, oxygen reduction potential, and the presence of breakdown products of the chemicals detected in groundwater. These data indicate that the conditions at the CRS Site are favorable for possible MNA of the VOCs detected in MW - 6 and at other areas of the CRS Site (Figures 4-11 through 4-17).

2.5.9.4.1 Lines of Evidence to Support MNA

Natural attenuation parameters were collected from all permanent monitoring wells. Review of the data suggest, for the most part, that with the exception of monitoring well MW-6, concentrations of VOCs dissolved in groundwater are below the detection levels or are detected in the 10's of parts per billion. Evaluation of natural attenuation of VOCs in groundwater was not considered for these wells as there are very little or no VOCs in groundwater to degrade.

Review of the groundwater analytical results (field and laboratory) from the most impacted groundwater monitoring well (MW-6) at the CRS Site indicate that there is evidence that VOCs are being naturally degraded. This conclusion was reached after

evaluating the concentrations or readings of key analytes versus established screening criteria for natural attenuation (NA) (Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater, EPA Office of Research and Development, EPA/600/R-98-128 – September 1998). The following analytes were used for comparison:

- Dissolved oxygen – Dissolved oxygen is the most thermodynamically favored electron acceptor used by microbes for biodegradation of organic carbon, whether natural or anthropogenic. Anaerobic bacteria generally cannot function at dissolved oxygen concentrations greater than about 0.5 mg/l, and hence, reductive dechlorination will not occur. The concentration of dissolved oxygen in MW-6 after the well stabilized was 0 mg/l, thus the conditions are favorable for reductive dechlorination of chlorinated solvents.

- Ferrous Iron – In some cases, ferric iron is used as an electron acceptor during anaerobic biodegradation of organic carbon. During this process, ferric iron is reduced to ferrous iron, which may be soluble in water. Ferrous iron concentrations can thus be used as an indicator of anaerobic degradation of fuel compounds and vinyl chloride. The concentration of ferrous iron in MW-6 was 2 mg/l. The concentrations of ferrous iron in unimpacted up gradient wells L-2 and L-3 was 0mg/l. The detectable concentrations of ferrous iron in MW-6 indicate that the reductive pathway is possible.

- Oxygen Reduction Potential (ORP) – The ORP of groundwater is a measure of electron activity and is an indicator of the relative tendency of a solution to accept or transfer electrons. Oxidation-reduction reactions in groundwater containing organic compounds (natural or anthropogenic) are usually biologically mediated, and, therefore, the ORP of a groundwater system depends upon and influences rates of biodegradation. An ORP of less than 50 mV indicates that the reductive pathway is possible. The ORP reading in MW-6 after it stabilized was 10 mV indicating the conditions are favorable for reductive dechlorination.

- Dissolved Hydrocarbons – During co-metabolism the carbon in hydrocarbons may be used an energy source for the bacteria performing the reductive dechlorination. Concentration of hydrocarbons (typically benzene, toluene, ethylbenzene and xylenes (BTEX) greater than 0.1 mg/l drive reductive dechlorination. The concentration of BTEX in MW-6 is 23mg/l indicating that the conditions are favorable for reductive dechlorination.

- Ethane/Ethene – As vinyl chloride degrades ethene may be produced followed by ethane. Concentrations of less than 0.1 mg/l indicate the

daughter product of vinyl chloride reduction. The concentration of ethane/ethene in MW-6 was 0.02 mg/l indicating that reductive dechlorination may be occurring.

- The TCE daughter products (such as DCE and vinyl chloride) were detected at the CRS Site. As trichloroethene degrades, Cis-1,2-dichlorothene (cis-1,2-DCE) may be produced. If cis-1,2-DCE is greater than 80 percent of total dichlorothene it is likely a daughter product and represents that reductive dechlorination is occurring. The concentration of cis-1,2-DCE in MW-6 was 76 mg/l while the concentration of total dichlorothene in MW-6 was 76 mg/l. The comparison of cis-1,2-DCE versus total dichloroethene concentrations indicates that cis-1,2-DCE is most likely the result of reductive dechlorination of trichloroethene.

These conditions are favorable for NA for the suite of VOCs detected in this and other areas of the CRS Site. The extent or magnitude to which VOCs in groundwater are being naturally degraded has not been evaluated at this time.

2.5.9.4.2 Location of Contamination and Migration

Primary release mechanisms at the CRS Site may include direct release, leaching, erosion, and precipitation associated runoff. Surface and subsurface soils and groundwater that have been impacted may act as secondary sources of contamination through mechanisms such as leaching of chemicals from soils, surface runoff, and groundwater recharge to surface water, and wind, and mechanical erosion of chemicals in soils. The media directly impacted at the CRS Site are soil and groundwater. The secondary sources of contamination are impacted soil and groundwater migration to surface water and sediments. Release mechanisms and transport pathways included subsurface soil leaching to groundwater, surface soil migrating to surface water and sediment, and groundwater transport to surface water and sediment

The following overview is presented as a site-specific discussion of the general physical and chemical features of contaminants found at the CRS Site, and how these apply to the occurrence and movement of chemicals.

Volatile organic compounds are characterized by relatively high vapor pressures and Henry's Law constants, indicating a strong potential for volatilization. Volatile constituents will enter the air in void spaces in the soil above the saturated zone. These constituents may then leave the system through the ground surface. The tendency of a compound to volatilize is usually expressed in terms of a Henry's Law constant K_H. Henry's Law holds in cases where the solute concentration is very low, which is applicable to most constituents found at hazardous waste sites. Henry's Law states that the concentration of a constituent in the vapor phase is directly proportional to the concentration of that constituent in the aqueous phase. The proportionality factor is the Henry's Law constant. Generally, for compounds with a Henry's Law constant less than

5×10^{-3}, volatilization from the soils will not be a major pathway (Dragun, 1988). The organic partition coefficients, K_{oc}, for volatile organic compounds vary from being highly mobile to being only moderately mobile.

VOCs were detected in groundwater at the CRS Site. However, the VOC concentrations in down-gradient monitoring wells are significantly less than the source well MW-6, which indicates the attenuation of VOCs. In addition, no chlorinated compounds were detected in any of the surface water samples.

2.6 Current and Potential Future Land and Water Uses

CRS Site is located in a setting of commercial/industrial parcels. The surrounding land uses are anticipated to be the same use in the future. New zoning restrictions would prohibit zoning of other land uses, except for industrial/commercial. Currently the CRS Site is being used for storage.

Future reasonably anticipated land use options for the CRS Site include light industrial and commercial. This could occur only after the selected remedy for soil is completed and all direct contact threats are removed.

The contaminated groundwater under CRS Site is characterized as shallow groundwater of poor quality water. Although the upper aquifer is not currently used as a drinking water source, the NCP requires that EPA restore contaminated groundwater to its beneficial use, which at the CRS Site means restoration to safe drinking water standards. There are no other current or potential beneficial uses associated with groundwater under CRS Site. The potential for on-site residential land use, which includes groundwater at the CRS Site as a drinking water source, is the most unlikely scenario and a hypothetical land use was used as a basis for reasonable exposure assessment assumptions and risk characterization conclusions discussed in Section 2.7.

2.7 Summary of Site Risks

The baseline risk assessment estimates what risks the CRS Site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by remedial action. This section of the ROD summarizes the results of the baseline risk assessment for the CRS Site.

2.7.1 Human Health Risk Assessment

EPA conducted a baseline risk assessment to determine the current and future effects of contaminants on human health and the environment. The CRS Site is zoned currently for industrial/commercial usage, which is also the reasonable anticipated future land use. Although there is no potential for the CRS Site to be zoned as residential property, EPA evaluated a hypothetical residential scenario for informational purposes.

The baseline risk assessment evaluated risk from CRS Site contamination under the following nine exposure scenarios:

(1) Occasional site visitor (current)
(2) Juvenile Trespasser (current)
(3) Juvenile Trespasser (future)
(4) Industrial Worker (future, indoor)
(5) Industrial Worker (future, outdoor)
(6) Hypothetical Resident (adult & child) Vapor Intrusion (Soil)
(7) Hypothetical Resident (adult & child) Vapor Intrusion (Groundwater)
(8) Hypothetical Resident (adult & child) Groundwater
(9) Hypothetical Resident (adult & child) Soil

The site-specific risks were quantified via calculations of daily intake and compared to acceptable reference doses. Potential exposure routes evaluated for the CRS Site included soil ingestion, soil dermal contact, inhalation of soil vapors (indoor and outdoor air), inhalation of groundwater vapors (indoor and outdoor air), sediment dermal contact, and surface water dermal contact. The groundwater exposure route is not complete. Municipal water is available, no drinking water sources are identified at the CRS Site or surrounding areas and the impacted groundwater is not and is unlikely to be used as a potable drinking water source. However, the NCP requires that EPA restore contaminated groundwater to its beneficial use, which at the CRS Site means restoration to safe drinking water standards. The potential migration of groundwater to surface water is not a concern because current sampling results show that chemicals detected in the down gradient monitoring wells and chemicals detected in the surface water samples are below the Ohio EPA water quality standards.

It is the EPA's current judgment that the Preferred Alternative identified in this Record of Decision (ROD), is necessary to protect human health and the environment from actual or threatened releases of hazardous substances into the environment

2.7.1.1 Identification of Chemicals of Concern

The Baseline Human Health Risk Assessment evaluated soil, groundwater, surface water and sediments. Only the soil and groundwater media were found to have significant risk resulting from exposure to Chemicals of Concern (COCs). Table 2 is a summary of the CRS Site Human Health Risk to the site-specific COCs, media, and their respective exposure pathway. Those COCs, their frequency of detection, range of detected concentrations, and the exposure point concentrations can be found in the RI Report Revision 3, August, 2006, Tables 6.1, 6.2, and 12.4.

2.7.1.2 Exposure Assessment

There were nine potentially exposed populations evaluated in the Baseline Human Health Risk Assessment. The nine Exposure Pathway Scenarios (EPS) evaluated included Current Use Commercial Site Visitor (EPS – 1), Current Use Juvenile Trespasser (EPS – 2), Future Use, Indoor Industrial or Commercial Worker (EPS - 3), Future Use, Indoor Industrial or Commercial

Worker (EPS – 4), Future Use Construction Worker (EPS – 5), Future Use Juvenile Trespasser (EPS – 6), Hypothetical Use, Indoor Resident Adult & Child (EPS – 7), Hypothetical Use, Indoor Gas Child & Adult (EPS – 8), Hypothetical Use, Resident Child & Adult, (EPS – 9). The exposure pathways evaluated can be found in the Conceptual Site Model, which is located in Section 2.5.1 of this ROD. The exposure assumptions used for the major exposure pathways for each scenario are summarized in Table 3.

2.7.1.3 Toxicity Assessment

Pertinent toxicological information on COPCs was selected from the following sources, in descending order of hierarchy:

- Integrated Risk Information System (IRIS)

IRIS is an EPA electronic database containing up-to-date health risk and EPA regulatory information for numerous chemicals. IRIS contains only toxicity criteria that have been verified by the EPA Work Groups and, consequently, is considered to be the preferred source of toxicity information. Information found on IRIS always supersedes all other sources.

2.7.1.4 Summary of the Human Health Risk Assessment

Based on the risk assessment results, the contaminants detected in soil, groundwater, surface water and sediments do not pose unacceptable risk and hazard under the current scenario. The impacted soil and groundwater would pose a potential unacceptable risk and hazard to human health under the future industrial/commercial and construction scenarios. Groundwater would pose an unacceptable risk if potable water wells are installed at the property. If land use is changed from industrial/commercial to residential, the contaminants detected in soils and groundwater would pose an unacceptable risk to future residents. Additionally, if land use of the site is changed to another use, a site-specific risk assessment should be completed to evaluate the risks associated with that specific scenario.

Table 2
Human Health Risk Assessment Summary of CRS Site Risks

Receptor	Total Cancer Risk	Total HI	Media/Exposure Pathway	Chemical of Concern (COC)
Site-visitor (Commercial) Current	2.0×10^{-5}	0.4	Soil	N/A
			Ingestion, inhalation, and dermal contact; inhalation of particulate in surface soils, inhalation of groundwater volatile chemicals outdoor air	
Industrial worker (Outdoor) Future	4.1×10^{-4}	8.0	Soil	PCE, TCA, 1,2-DCA & Vinyl chloride
				Aroclors: 1242, 1248, 1245, & 1260
			Soil ingestion, inhalation, and dermal contact	Arsenic,
				Benzene,
				Chloroform
				trans-1,3-Dichloropropene,
				Dibromochloromethane
Industrial or Commercial worker (Indoor)* Future	2.7×10^{-2}	357	Soil & Groundwater Vapors *Inhalation of soil & groundwater volatiles. These exposure pathways would be complete on if a building is constructed over the impacted area. **Vapor to indoor air may require further investigation if a building is placed on-site*	PCE, 1,1,1-TCE, 1,1,2-TCE.
				1,1-dichloroethene, & 1,1-DCA
				1,2-Dichloroethane,
				BTEX & Chloroethane,
				Chloroform, & Cis-1,2-dichloroethane
				Dibromochloromethane
				Methylene Chloride
				Naphthalene and Trans 1,3-dichloropropene

Receptor	Total Cancer Risk	Total HI	Media/Exposure Pathway	Chemical of Concern (COC)
Construction worker Future	1.3×10^{-5}	8.4	Soil & Groundwater;	TCA
			Direct contact & incidental ingestion of soil	Aroclors 1242, & 1254
Juvenile Trespasser Future	8.7×10^{-5}	3.0*	Soil, Groundwater, Surface Water Sediment	N/A
			Ingestion, inhalation & dermal contact	*Although the total hazard index is above the target level of 1.0. The hazard indices for individual target organs are below the target hazard level of 1.0. Therefore, the potential exposure to chemicals in these media should not result in adverse health effects for the receptor.
Resident Hypothetical Indoor	1.4×10^{-1}	1275	Soil & Groundwater	PCE
				1,1,1-TCA,
				1,1-DCA,
				1,1-DCE,
				1,2-DCA,
			Incidental ingestion, inhalation & dermal contact *Ingestion of shallow groundwater (private water well user)*	Benzene,
				Methylene Chloride
				Toluene
Resident Hypothetical Outdoor	1.0×10^{-3}	55	Soil	1, 2-DCA, & Vinyl Chloride
			Direct contact	Aroclors: 1221, 1242, 1248, 1254 & 1260
				Antimony, Arsenic, & Xylene
				PCE & TCE
				Benzo(a,h)anthracene
				Benzo(a)anthracene & Benzo(a)pyrene
				Indeno (1,2,3-c,d)pyrene

Receptor	Total Cancer Risk	Total HI	Media/Exposure Pathway	Chemical of Concern (COC)
Resident Hypothetical (Indoor gas)	$1.4x\ 10^{-2}$	1203	Soil vapors *Inhalation **Vapors to indoor air may require further investigation if a building is placed on-site.*	Benzene, Chloroethane, cis-1,2-Dichloroethane, Methyl Chloride, Xylene, Naphthalene, and Chloroethane
Resident Hypothetical (Indoor gas)	$2.4\ x\ 10^{-4}$	17	Groundwater vapors *inhalation *Vapor to indoor air may require further investigation if a building is placed on-site.	Benzene, Chloroethane, cis-1,2-Dichloroethane, Methyl Chloride, Xylene, and Naphthalene
Resident Hypothetical	$4.9\ x\ 10^{-4}$	27	*Groundwater Incidental ingestion, inhalation & dermal contact *Ingestion of deep groundwater (private water well user)*	Benzene, Vinyl Chloride, Arsenic and Manganese

Table 2 cont. –Human Health Risk Assessment Summary of CRS Site Risks

Table 3
Exposure Assessment for Each Media (Human Health)

TABLE 11

PAGS PART D TABLE 1

SELECTION OF EXPOSURE PATHWAYS

ORS Site

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Soil	Soil	Surface soil (0-4')	Commercial Site Visitors	Adult	Ingestion	Quant	The site is currently a vacant storage facility. There are no regular commercial workers at the site. Occasional commercial site visitors may access the property.
						Dermal contact	Quant	The site is currently a vacant storage facility. There are no regular commercial workers at the site. Occasional commercial site visitors may access the property.
				Trespassers	Juvenile	Ingestion	Quant	Although the access to the facility is limited due to the fence, there is no fence along the Black River.
						Dermal contact	Quant	Although the access to the facility is limited due to the fence, there is no fence along the Black River.
			Mixed soil (0-10')	Construction Workers	Adult	Ingestion	Qual	No construction activities occur at the site.
						Dermal	Qual	No construction activities occur at the site.
			Ambient Air (0-4')	Commercial Site Visitors	Adult	Inhalation	Quant	The site is currently a vacant storage facility. There are no regular commercial workers at the site. Occasional commercial site visitors may access the property.
				Trespassers	Juvenile	Inhalation	Quant	Although the access to the facility is limited due to the fence, there is no fence along the Black River.
				Construction Workers	Adult	Inhalation	Qual	No construction activities occur at the site.
			Indoor Air (0-10')	Commercial Workers	Adult	Inhalation	Qual	The site is currently a vacant storage facility. There are no regular commercial workers at the site.
	Groundwater	Groundwater	Ambient Air	Commercial Site Visitors	Adult	Inhalation	Qual	Although occasional commercial site visitors may access the storage facility, the groundwater volatilization to ambient air pathway is insignificant comparing to the soil direct contact exposure pathways.
				Trespassers	Juvenile	Inhalation	Quant	Although the access to the facility is limited due to the fence, there is no fence along the Black River.
				Construction Workers	Adult	Inhalation	Qual	No construction activities occur at the site.
			Indoor Air	Commercial Site Visitors	Adult	Inhalation	Qual	The site is currently a vacant storage facility. There are no regular commercial workers at the site. Occasional commercial site visitors may access the property. However, the potential site visitors do not work in the on-property building.
			Shallow Groundwater	Construction Workers	Adult	Dermal Contact	Qual	No construction activities occur at the site.
			Tap Water	Commercial Workers	Adult	Ingestion Inhalation during showering Dermal contact during showering	Qual	Groundwater at the site is not used for potable consumption. No drinking water wells are identified at the site or within 1 mile of the site. No drinking water intake source within 4 miles along the river.
	Surface Water	Surface Water	Black River	Trespassers	Juvenile	Dermal contact	Quant	Human exposures through swimming or wading in the river are unlikely because the River is deep and there is a city swimming adversory for the River. Wading is a potentially complete exposure pathway since the depth of the River is between 2 to 10 feet.

Table 3 cont.
Exposure Assessment for Each Medial (Human Health)

RAGS PART D TABLE 1

SELECTION OF EXPOSURE PATHWAYS

CRS Site

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current (cont.)	Sediment	Sediment	Bank of Black River	Trespassers	Juvenile	Incidental Ingestion	Quant	Human exposures through swimming or wading in the river are unlikely because the River is deep and there is a city swimming advisory for the River. Therefore, direct contact to sediment in the river is incomplete. However, there is potential for a trespasser to be exposed to sediment on the narrow river bank.
						Dermal contact	Quant	Human exposures through swimming or wading in the river are unlikely because the River is deep and there is a city swimming advisory for the River. Therefore, direct contact to sediment in the river is incomplete. However, there is potential for a trespasser to be exposed to sediment on the narrow river bank.
						Inhalation	Quant	Human exposures through swimming or wading in the river are unlikely because the River is deep and there is a city swimming advisory for the River. Therefore, direct contact to sediment in the river is incomplete. However, there is potential for a trespasser to be exposed to sediment on the narrow river bank.
Future	Soil	Soil	Surface soil (0-4')	Commercial Workers (Outdoor)	Adult	Ingestion	Quant	Under the anticipated future commercial scenario, commercial workers may be exposed to the contaminated soil.
						Dermal contact	Quant	Under the anticipated future commercial scenario, commercial workers may be exposed to the contaminated soil.
				Trespassers	Juvenile	Ingestion	Quant	Under the anticipated future commercial scenario, a juvenile trespasser may be exposed to the contaminated soil.
						Dermal contact	Quant	Under the anticipated future commercial scenario, a juvenile trespasser may be exposed to the contaminated soil.
			Mixed soil (0-10')	Construction Workers	Adult	Ingestion	Quant	Under the anticipated future commercial scenario, construction workers may be exposed to the contaminated soil.
						Dermal contact	Quant	Under the anticipated future commercial scenario, construction workers may be exposed to the contaminated soil.
			Mixed soil (0-10')	Hypothetical Residents	Adult and child	Ingestion	Quant	Although the anticipated future use for the site is industrial, a hypothetical residential scenario is also evaluated for the site. A hypothetical resident may be exposed to the contaminated soil.
						Dermal contact	Quant	Although the anticipated future use for the site is industrial, a hypothetical residential scenario is also evaluated for the site. A hypothetical resident may be exposed to the contaminated soil.
			Ambient Air (0-4')	Commercial Workers (Outdoor)	Adult	Inhalation	Quant	Under the anticipated future commercial scenario, commercial workers may be exposed to the contaminated soil through soil volatilization to ambient air.
				Trespassers	Juvenile	Inhalation	Quant	Under the anticipated future commercial scenario, a juvenile trespasser may be exposed to the contaminated soil through soil volatilization to ambient air.

SELECTION OF EXPOSURE PATHWAYS

CRS Site

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
	Surface Water	Surface Water	Black River	Trespassers	Juvenile	Dermal contact	Quant	Human exposures through swimming in the river are unlikely because the River is deep and there is a city swimming advisory for the River. Wading is a potentially complete exposure pathway since the depth of the River is between 2 to 10 feet.
	Sediment	Sediment	Bank of Black River	Trespassers	Juvenile	Direct contact including incidental ingestion, inhalation and dermal contact.	Quant	Although human exposures through swimming and wading in the river are unlikely because of the presence of dams up and downstream of the site and there is a city swimming advisory for the River; wading is a potential activity. There is potential for a trespasser to be exposed to sediment on the narrow river bank and the sediments in the the interphase of surface water.

- Other Toxicity Values

Below are additional EPA and non-EPA sources of toxicity information. Priority should be given to those sources of information that are the most current, the basis for which is transparent and publicly available, and which have been peer reviewed. The additional sources used in the risk assessment include the following sources.

- The California Environmental Protection Agency (Cal EPA) toxicity values (http://www.oehha.ca.gov/risk/chemicalDB//index.asp).

- The Oak Ridge National Laboratory Risk Assessment Information System toxicity values (http://risk/lsd.ornl.gov/index.shtml).

The assessment looked at both carcinogenic and non-carcinogenic effects. Table 2 is a summary of the carcinogenic risk, and the non-carcinogenic risk information, which is relevant to the contaminants of concern in both soil and groundwater.

2.7.1.5 Risk Characterization

For carcinogens, risks are generally expressed as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

$$Risk = CDI \times SF$$

where:

Risk = a unit less probability (e.g., 2×10^{-5}) of an individual's developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor, expressed as $(mg/kg\text{-}day)^{-1}$.

An excess lifetime cancer risk of $1x10^{-6}$ indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual's developing cancer from all other causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site-related exposures is $1x10^{-4}$ to $1x10^{-6}$.

The potential for non-carcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., life-time) with a reference dose (RfD) derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). A HQ less than 1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic non-carcinogenic effects from that chemical are unlikely. The

Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. A HI less than 1 indicates that, based on the sum of all HQ's from different contaminants and exposure routes, toxic non-carcinogenic effects from all contaminants are unlikely. A HI greater than 1 indicates that site-related exposures may present a risk to human health. The HQ is calculated as follows:

$$\text{Non-cancer HQ} = \text{CDI/RfD}$$

where:

CDI = Chronic daily intake
RfD = reference dose.

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, sub chronic, or short-term).

The BHHRA did not evaluate sediments because it was felt that human exposure was unlikely or extremely limited due to the sediments being covered by water. Risks that exceed a Hazard Index of 1 or a carcinogenic risk of $1x10^{-6}$ are presented in Table 2. Risks for surface water (combined drainage ditches and ponds) and risks for EPS-4 (Future Construction Worker) were evaluated but had hazard indices of less than one and cancer risks less than $1x10^{-6}$, and therefore are not included in Table 2. The summed risks are presented using only one significant figure.

2.7.1.6 Uncertainty Analysis

Uncertainties in the BHHRA included several factors. These are discussed in the following paragraphs.

For chemicals that were not detected in individual samples, it was assumed that one-half the Sample Quanitation Limit (SQL) was representative of the concentration that may be present in soil or groundwater for purposes of calculating the arithmetic average and 95% upper confidence limit (UCL) concentrations. The current default position of EPA (1989) is to substitute one-half the SQL for all non-detects. EPA guidance (1992b) indicates that substitution of one-half of the SQL is adequate when the proportion of non-detects is less than 10 to 15 percent.

Conservative fate and transport models were used to estimate indoor and ambient air concentrations of COPCs volatilized from soil and groundwater. The models are highly sensitive to site-specific variables such as soil moisture content and soil organic carbon content. The model results are typically conservative. In addition, using the soil concentrations instead of soil gas data to evaluate the volatilization to indoor air pathway and adding the soil and groundwater volatilization to indoor air exposure pathways for the receptors may also result in conservative risks/hazards.

The exposure assessment is based on a reasonable maximum exposure (RME) scenario, which is defined by EPA as the highest exposure that could reasonably be expected to occur for a given exposure pathway at a site (EPA, 1989). To achieve this goal, the RME is based on conservative exposure assumptions. For example, the evaluation assumes that a commercial/industrial worker will be present on-site for 250 days per year for 25 years. For a construction worker, exposure was assumed to occur for 120 days per year over one year, which may or may not be greater than many site construction projects. This and other upper-bound estimates of exposure could possibly overestimate the potential health risks associated with exposure to the COPCs in soil. In addition, the default soil adherence factors for the current commercial site visitors and juvenile trespassers may be conservative, which could possibly result in conservative estimates of risk. A 30-year exposure assumption (24 years as an adult and 6 years as a child) may also be a conservative number because it represents a small percentage of households that live in the same home for 30 years. A central tendency scenario was not calculated for the CRS Site because remediation goals are not developed based on a central tendency scenario. Central tendency is recommended by EPA guidance as it can provide useful information when the risk calculated based on the reasonable maximum exposure slightly exceeds the target risk and target hazard index, which is not the case at the CRS Site. Therefore, central tendency was not calculated for this site.

The toxicity criteria used in the HHRA are based on an evaluation of non-carcinogenic and carcinogenic health risks that were developed using different methods. The non-carcinogenic criteria (i.e., oral and inhalation RfDs) incorporate multiple uncertainty factors to account for limitations in the quality or quantity of available data (e.g., animal data in lieu of human data). These uncertainty factors are also applied to available data to take into account variation in human response. Therefore, RfDs may be smaller than the doses that would cause adverse health effects. This development of RfDs could possibly overestimate the potential for non-carcinogenic health risks.

For compounds without toxicity values, either surrogate values or route to route extrapolations were used, which could result in possible overestimation of risks/hazards. The draft trichloroethene oral reference dose from National Center for Environmental Assessment (NCEA) was used for the risk calculation in this human heath risk assessment. The draft value is currently being reevaluated by NCEA due to uncertainties associated with the studies used to develop the draft value. Comparing to the IRIS withdrawn oral RfD that was used in a previous version of the human health risk assessment (RI Revision I, July 2005), the draft value is twenty times lower than the withdrawn value. The use of the conservative draft value could potentially overestimate the hazard level.

2.7.2 Summary of Ecological Assessment

Ecological risks will be expressed in terms of a definite endpoint, which is defined as an environmental value to be protected. Assessment endpoints are “explicit expressions of the actual environmental value that is to be protected” (EPA 1998). The assessment endpoints provide a transition between broad management, or policy goals, and the specific measures used in the assessment.

In this approach, the proposed assessment endpoints are the survival and reproduction of wildlife populations (associated with suitable habitat) that may be affected by previous CRS Site

operations. The assessment endpoints are addressed through the survival and reproduction of terrestrial animal and plant populations at the CRS Site and the survival and reproduction of aquatic plants and animals inhabiting the East Branch Black River adjacent to the CRS Site.

A measure of effect (measurement endpoint) is a measurable ecological characteristic that is related to the valued characteristic chosen as the assessment endpoint (EPA 1998). Effects relative to the assessment endpoint were extrapolated from the selected measurement endpoints. In general, the lowest reported no-observed-adverse-effect level (NOAEL) screening benchmark was used as the measurement endpoint for this screening level ecological risk assessment (SLERA). If a NOAEL was unavailable, the lowest-observed-adverse-effect-level (LOAEL) multiplied by an uncertainty factor of 0.1 was used as a surrogate measurement endpoint for comparison purposes. For soils, NOAELs were selected according to the following hierarchy:

1. EPA Ecological Soil Screening Levels (Eco-SSLs), March 2005;

2. Ecological Screening Levels (ESLs) from EPA Region 5, 2003; and,

3. Efroymson, et. al., 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process.

For sediments, NOAELs were selected according to the hierarchy listed as follows:

1. TEC - Threshold Effects Concentration, PEC - Probable Effects Concentration, MEC-Midpoint Value between TEC and PEC, from the Risk Assessment Information System, an on-line database maintained by the U.S. Department of Energy, Oak Ridge National Laboratory and the University of Tennessee;

2. Ecological Screening Levels (ESLs) from U.S. EPA Region 5, 2003;

3. NOAA Effects Range Low (ER-L) concentrations. Obtained from the Risk Information System;

4. Ontario Ministry of the Environment "Low" effects concentration. Obtained from the Risk Assessment Information System; and

5. Washington No Effects Level (NEL) concentration for freshwater. Obtained from the Risk Assessment Information System.

For surface water, NOAELs were selected according to following hierarchy:

1. Ohio Environmental Protection Agency, Division of Surface Water, Outside Mixing Zone Average for the Lake Erie Drainage Basin, Effective 08/05/04;

2. Ecological Screening Levels (ESLs) from U.S. EPA Region 5, 2003; and

3. Region 6 Freshwater Surface Water Screening Benchmark.

Since indications of beaver foraging use were directly observed along the riverbank adjacent to the CRS Site, impacts to beavers utilizing the CRS Site were specifically evaluated in this SLERA. However, life history parameters (e.g., average body weight, food ingestion rate, and water ingestion rate) for beavers are not well defined; therefore, the muskrat was used as an indicator species for herbivorous mammals, such as beavers. The muskrat was determined to be a suitable surrogate species for the beaver since the muskrat has a smaller average body weight, smaller home range, and occupies a similar trophic level (herbivore) as the beaver.

2.7.2.1 Identification of Chemicals of Concern

Soil, surface water, sediment, and groundwater samples were collected in order to define the nature and extent of the contamination. The following subsections summarize the results of the screening of these data to appropriate ecological benchmarks to identify compounds of potential ecological concern (COPECs). Tables 4 through 6 present the results of the sampling data as compared to applicable ecological screening benchmarks.

Table 4-1 Summary of Soil Data (0-4' (Ecological))

TABLE 1

Chemical Recovery Systems Superfund Site
Elyria, Lorain County, Ohio

SUMMARY OF SOIL DATA (0 - 4 feet)

Contaminant of Interest	Range of Detection Limits		Range of Detected Concentrations		Frequency of Detection	Arithmetic Average of Detected Concentrations	Exposure Point Concentration	Screening Benchmark and Reference[1]		HQ	PECOC Decision
	Minimum	Maximum	Minimum	Maximum							
Chloroethane	0.0039	76	130	130	1/65	130	130	-		-	No; detection frequency <3% and not bioaccumulative
Chloroform	0.0039	76	1.5	430	3/65	207	430	1190	(2)	0.36	No; HQ<1
Chloromethane	0.0039	76	NA	NA	0/65	NA	NA	10400	(2)	-	No; not detected
cis-1,2-Dichloroethene	0.002	38	0.35	160000	44/65	9610	160000	784	(2)	204.1	Yes; HQ>1
cis-1,3-Dichloropropene	0.0039	76	NA	NA	0/65	NA	NA	398	(2)	-	No; not detected
Dibromochloromethane	0.0039	76	NA	NA	0/65	NA	NA	2050	(2)	-	No; not detected
Ethylbenzene	0.0039	76	0.49	870000	50/65	22900	870000	5160	(2)	168.6	Yes; HQ>1
Methylene chloride	0.0039	76	110	17000	21/65	1880	17000	4050	(2)	4.2	Yes; HQ>1
Styrene	0.0039	76	19	3000	3/65	1300	3000	4690	(2)	0.64	No; HQ<1
Tetrachloroethene	0.0039	76	1.1	480000	58/65	19700	480000	9920	(2)	48.4	Yes; HQ>1
Toluene	0.0039	76	2.3	1500000	52/65	50200	1500000	5460	(2)	275.2	Yes; HQ>1
trans-1,2-Dichloroethene	0.002	38	0.19	20000	18/65	2100	20000	784	(2)	25.5	Yes; HQ>1
trans-1,3-Dichloropropene	0.0039	76	1800	1800	1/65	1800	1800	398	(2)	4.5	No; detection frequency <3% and not bioaccumulative
Trichloroethene	0.0039	76	0.23	450000	61/65	30900	450000	12400	(2)	36.3	Yes; HQ>1
Vinyl chloride	0.0039	76	140	1800	4/65	927	1800	646	(2)	2.8	Yes; HQ>1
Xylenes (total)	0.0079	150	0.49	5100000	55/65	141000	5100000	10000	(2)	510.0	Yes; HQ>1
SVOCs Method SW 846 8270C (ug/kg)											
1,2,4-Trichlorobenzene	0.35	81	NA	NA	0/65	NA	NA	11100	(2)	-	No; not detected
1,2-Dichlorobenzene	0.35	81	NA	NA	0/65	NA	NA	2980	(2)	-	No; not detected
1,3-Dichlorobenzene	0.35	81	NA	NA	0/65	NA	NA	27700	(2)	-	No; not detected
1,4-Dichlorobenzene	0.35	81	NA	NA	0/65	NA	NA	646	(2)	-	No; not detected
2,2'-Oxybis(1-Chloropropane)	0.35	81	NA	NA	0/65	NA	NA	19900	(2)	-	No; not detected
2,4,5-Trichlorophenol	0.35	81	260	260	1/65	260	260	14100	(2)	0.02	No; HQ<1
2,4,6-Trichlorophenol	0.35	81	NA	NA	0/65	NA	NA	9940	(2)	-	No; not detected
2,4-Dichlorophenol	0.35	81	NA	NA	0/65	NA	NA	87500	(2)	-	No; not detected
2,4-Dimethylphenol	0.35	81	350	1200	2/65	775	1200	10	(2)	120.0	No; detection frequency <3% and not bioaccumulative
2,4-Dinitrophenol	1.7	390	NA	NA	0/65	NA	NA	609	(2)	-	No; not detected
2,4-Dinitrotoluene	0.35	81	NA	NA	0/65	NA	NA	1280	(2)	-	No; not detected
2,6-Dinitrotoluene	0.35	81	NA	NA	0/65	NA	NA	32.8	(2)	-	No; not detected
2-Chloronaphthalene	0.35	81	NA	NA	0/65	NA	NA	12.2	(2)	-	No; not detected
2-Chlorophenol	0.35	81	NA	NA	0/65	NA	NA	243	(2)	-	No; not detected
2-Methylnaphthalene	0.35	81	33	84000	37/65	2990	84000	3240	(2)	25.9	Yes; HQ>1
2-Methylphenol	0.35	81	150	850	2/65	500	850	40400	(2)	0.02	No; HQ<1
2-Nitroaniline	1.7	390	NA	NA	0/65	NA	NA	74100	(2)	-	No; not detected
2-Nitrophenol	0.35	81	NA	NA	0/65	NA	NA	1600	(2)	-	No; not detected
3,3'-Dichlorobenzidine	1.7	390	NA	NA	0/65	NA	NA	646	(2)	-	No; not detected
3-Nitroaniline	1.7	390	NA	NA	0/65	NA	NA	3160	(2)	-	No; not detected
4,6-Dinitro-2-methylphenol	1.7	390	NA	NA	0/65	NA	NA	144	(2)	-	No; not detected
4-Bromophenyl phenyl ether	0.35	81	NA	NA	0/65	NA	NA	NA		-	No; not detected
4-Chloro-3-methylphenol	0.35	81	NA	NA	0/65	NA	NA	NA		-	No; not detected
4-Chloroaniline	0.35	81	NA	NA	0/65	NA	NA	1100	(2)	-	No; not detected
4-Chlorophenyl phenyl ether	0.35	81	NA	NA	0/65	NA	NA	NA		-	No; not detected
4-Methylphenol	0.35	81	280	2000	5/65	836	2000	163000	(2)	0.01	No; HQ<1
4-Nitroaniline	1.7	390	NA	NA	0/65	NA	NA	21900	(2)	-	No; not detected
4-Nitrophenol	1.7	390	NA	NA	0/65	NA	NA	5120	(2)	-	No; not detected
Acenaphthene	0.35	81	21	1400	11/65	401	1400	682000	(2)	0.00	No; HQ<1
Acenaphthylene	0.35	81	28	8600	24/65	987	8600	682000	(2)	0.01	No; HQ<1
Anthracene	0.35	81	24	8800	25/65	1130	8800	1480000	(2)	0.01	No; HQ<1
Benz(a)anthracene	0.35	81	51	39000	41/65	2620	39000	5210	(2)	7.5	Yes; HQ>1

Table 4-2 Summary of Sediment Data (Ecological)

TABLE 2

Chemical Recovery Systems Superfund Site
Elyria, Lorain County, Ohio

SUMMARY OF SEDIMENT DATA

Contaminant of Interest	Range of Detection Limits		Range of Detected Concentrations		Frequency of Detection	Arithmetic Average of Detected Concentrations	Exposure Point Concentration	Screening Benchmark and Reference[1]						HQ	PECOC Decision
								TEC	MEC	PEC	Region 5 ESL	Other	Reference		
	Minimum	Maximum	Minimum	Maximum											
TAL Metals Method SW 846 6010B (mg/kg)															
Aluminum	2.72E+01	4.07E+01	3330	8290	7/7	5040	8290	-	-	-	-	-		-	Yes; benchmark not available
Antimony	8.20E+00	1.22E+01	0.6	4.8	6/7	2.03	4.8	-	-	-	-	2	(3)	2.40	Yes; HQ>1
Arsenic	6.80E-01	1.00E+00	2.5	8.9	7/7	5.59	8.9	9.8	21.4	33			(1)	0.91	No; HQ<1
Barium	2.72E+01	4.07E+01	28.7	99.4	7/7	53.6	99.4	-	-	-	-	-		-	Yes; benchmark not available
Beryllium	6.80E-01	1.00E+00	0.27	0.52	6/7	0.352	0.52	-	-	-	-	-		-	Yes; benchmark not available
Cadmium	6.80E-01	1.00E+00	1.2	3.6	6/7	2.16	3.6	0.99	5	5			(1)	3.64	Yes; HQ>1
Calcium	6.80E+02	1.02E+03	697	7380	7/7	5130	7380	-	-	-	-	-		-	No; essential nutrient
Chromium	1.40E+00	2.00E+00	3.5	22.6	7/7	14.7	22.6	43	76.5	110			(1)	0.53	No; HQ<1
Cobalt	6.80E+00	1.02E+01	1.4	11.8	7/7	7.59	11.8	-	-	-	50	-	(2)	0.24	No; HQ<1
Copper	3.40E+00	5.10E+00	6	81.5	7/7	37.1	81.5	32	91	150	-	-	(1)	2.66	Yes; HQ>1
Iron	1.36E+01	2.04E+01	4170	19500	7/7	12200	19500	-	-	-	-	20000	(4)	0.98	No; HQ<1
Lead	4.10E-01	6.10E-01	12.3	94.4	7/7	33.2	94.4	36	83	130	-	-	(1)	2.62	Yes; HQ>1
Magnesium	6.80E+02	1.02E+03	312	3180	7/7	2040	3180	-	-	-	-	-		-	No; essential nutrient
Manganese	2.00E+00	3.10E+00	144	491	7/7	314	491	-	-	-	-	460	(4)	1.07	Yes; HQ>1
Mercury	1.40E-01	2.00E-01	0.033	0.091	4/7	0.0643	0.091	0.18	0.64	1.1	-	-	(1)	0.51	No; HQ<1
Nickel	5.40E+00	8.10E+00	6.3	31.6	7/7	19.8	31.6	23	36	49	-	-	(1)	1.37	Yes; HQ>1
Selenium	6.80E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	-	-		-	No; not detected
Silver	1.40E+00	2.00E+00	NA	NA	0/7	NA	NA	-	-	-	500		(2)	-	No; not detected
Sodium	6.80E+02	1.02E+03	NA	NA	0/7	NA	NA	-	-	-	-	-		-	No; not detected
Thallium	1.40E+00	2.00E+00	NA	NA	0/7	NA	NA	-	-	-	-	-		-	No; not detected
Vanadium	6.80E+00	1.02E+01	7.5	17.3	7/7	10.8	17.3	-	-	-	-	-		-	Yes; benchmark not available
Zinc	2.70E+00	4.10E+00	65.4	124	6/7	85.8	124	120	290	460	-	-	(1)	1.03	Yes; HQ>1
PCBs Method SW 846 8082 (mg/kg)															
Aroclor 1016	4.50E-02	6.70E-02	NA	NA	0/7	NA	NA	0.05	0.368	0.676	-	-	(1)	-	No; not detected
Aroclor 1221	4.50E-02	6.70E-02	NA	NA	0/7	NA	NA	0.05	0.368	0.676	-	-	(1)	-	No; not detected
Aroclor 1232	4.50E-02	6.70E-02	NA	NA	0/7	NA	NA	0.05	0.368	0.676	-	-	(1)	-	No; not detected
Aroclor 1242	4.50E-02	6.70E-02	0.06	0.062	3/7	0.07	0.062	0.05	0.368	0.676	-	-	(1)	1.64	Yes; HQ>1
Aroclor 1248	4.50E-02	6.70E-02	NA	NA	0/7	NA	NA	0.05	0.368	0.676	-	-	(1)	-	No; not detected
Aroclor 1254	4.50E-02	6.70E-02	0.018	0.018	1/7	0.018	0.018	0.05	0.368	0.676	-	-	(1)	0.36	Yes; because Aroclor 1242 PECOC
Aroclor 1260	4.50E-02	6.70E-02	0.012	0.026	3/7	0.0193	0.026	0.05	0.368	0.676	-	-	(1)	0.52	Yes; because Aroclor 1242 PECOC
VOCs Method SW 846 8260B (ug/kg)															
1,1,1-Trichloroethane	3.60E-03	4.60E-03	0.93	0.93	1/7	0.93	0.93	-	-	-	213	-	(2)	-	No; HQ<1
1,1,2,2-Tetrachloroethane	3.60E-03	4.60E-03	NA	NA	0/7	NA	NA	-	-	-	350	-	(2)	-	No; not detected
1,1,2-Trichloroethane	3.60E-03	4.60E-03	NA	NA	0/7	NA	NA	-	-	-	510	-	(2)	-	No; not detected
1,1-Dichloroethane	3.60E-03	4.60E-03	NA	NA	0/7	NA	NA	-	-	-	0.575	-	(2)	-	No; not detected
1,1-Dichloroethene	3.60E-03	4.60E-03	0.72	1.1	2/7	0.91	1.1	-	-	-	19.4	-	(2)	0.06	No; HQ<1
1,2-Dichloroethane	3.60E-03	4.60E-03	NA	NA	0/7	NA	NA	-	-	-	260	-	(2)	-	No; not detected
1,2-Dichloroethene (total)	3.60E-03	4.60E-03	0.87	1.2	2/7	1.03	1.2	-	-	-	654	-	(2)	0.00	No; HQ<1
1,2-Dichloropropane	3.60E-03	4.60E-03	NA	NA	0/7	NA	NA	-	-	-	330	-	(2)	-	No; not detected
2-Butanone	1.50E-02	1.90E-02	4.4	8.7	7/7	6.04	8.7	-	-	-	42.4	-	(2)	0.21	No; HQ<1
2-Hexanone	1.50E-02	1.90E-02	NA	NA	0/7	NA	NA	-	-	-	50	-	(2)	-	No; not detected
4-Methyl-2-pentanone	1.50E-02	1.90E-02	NA	NA	0/7	NA	NA	-	-	-	20	-	(2)	-	No; not detected
Acetone	1.50E-02	1.90E-02	66	130	6/7	85.5	130	-	-	-	9.9	-	(2)	13.13	Yes; HQ>1
Benzene	3.60E-03	4.60E-03	0.37	4	7/7	1.3	4	-	-	-	140	-	(2)	0.03	No; HQ<1
Bromodichloromethane	3.60E-03	4.60E-03	NA	NA	0/7	NA	NA	-	-	-	-	-		-	No; not detected
Bromoform	3.60E-03	4.60E-03	NA	NA	0/7	NA	NA	-	-	-	400	-	(2)	-	No; not detected
Bromomethane	3.60E-03	4.60E-03	5.4	5.4	1/7	5.4	5.4	-	-	-	1.37	-	(2)	3.94	Yes; HQ>1
Carbon disulfide	3.60E-03	4.60E-03	1.3	8.2	7/7	3.16	8.2	-	-	-	23.9	-	(2)	0.34	No; HQ<1
Carbon tetrachloride	3.60E-03	4.60E-03	0.59	0.59	1/7	0.59	0.59	-	-	-	1450	-	(2)	0.00	No; HQ<1
Chlorobenzene	3.60E-03	4.60E-03	NA	NA	0/7	NA	NA	-	-	-	200	-	(2)	-	No; not detected
Chloroethane	3.60E-03	4.60E-03	1.7	1.7	1/7	1.7	1.7	-	-	-	-	-		-	Yes; benchmark not available

Table 4-2 cont.
Summary of Sediment Data (Ecological)

SUMMARY OF SEDIMENT DATA

Contaminant of Interest	Range of Detection Limits		Range of Detected Concentrations		Frequency of Detection	Arithmetic Average of Detected Concentrations	Exposure Point Concentration	Screening Benchmark and Reference[1]						HQ	PECOC Decision
	Minimum	Maximum	Minimum	Maximum				TEC	MEC	PEC	Region 6 ESL	Other	Reference		
Chloroform	3.00E-03	4.90E-03	0.7	0.7	1/7	0.7	0.7	-	-	-	121	-	(2)	0.01	No; HQ<1
Chloromethane	3.00E-03	4.90E-03	2.4	2.4	1/7	2.4	2.4	-	-	-	-	-		-	Yes; benchmark not available
cis-1,2-Dichloroethene	1.90E-03	2.30E-03	0.31	0.82	5/7	0.6	0.87	-	-	-	654		(2)	0.00	No; HQ<1
cis-1,3-Dichloropropene	3.00E-03	4.90E-03	NA	NA	0/7	NA	NA	-	-	-	-	-		-	No; not detected
Dibromochloromethane	3.00E-03	4.90E-03	NA	NA	0/7	NA	NA	-	-	-	1110	-	(2)	-	No; not detected
Ethylbenzene	3.00E-03	4.90E-03	0.94	0.94	1/7	0.94	0.94	-	-	-	175	-	(2)	0.01	No; HQ<1
Methylene chloride	3.00E-03	4.90E-03	NA	NA	0/7	NA	NA	-	-	-	190	-	(2)	-	No; not detected
Styrene	3.00E-03	4.90E-03	2.3	2.3	1/7	2.3	2.3	-	-	-	254	-	(2)	0.01	No; HQ<1
Tetrachloroethene	3.00E-03	4.90E-03	1	3.3	3/7	2.13	3.3	-	-	-	890	-	(2)	0.00	No; HQ<1
Toluene	3.00E-03	4.90E-03	0.91	3.7	7/7	1.83	3.7	-	-	-	1220	-	(2)	0.00	No; HQ<1
trans-1,2-Dichloroethene	1.90E-03	2.30E-03	NA	NA	0/7	NA	NA	-	-	-	650	-	(2)	-	No; not detected
trans-1,3-Dichloropropene	3.00E-03	4.90E-03	NA	NA	0/7	NA	NA	-	-	-	-	-		-	No; not detected
Trichloroethene	3.00E-03	4.90E-03	0.64	1.4	7/7	0.793	1.4	-	-	-	112	-	(2)	0.01	No; HQ<1
Vinyl chloride	3.00E-03	4.90E-03	1.5	1.5	1/7	1.5	1.5	-	-	-	202	-	(2)	0.01	No; HQ<1
Xylenes (total)	7.00E-03	9.30E-03	3.4	7	7/7	4.51	7	-	-	-	430	-	(2)	0.02	No; HQ<1
SVOCs Method SW 846 8270C (ug/kg)															
1,2,4-Trichlorobenzene	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	6080	-	(2)	-	No; not detected
1,2-Dichlorobenzene	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	280	-	(2)	-	No; not detected
1,3-Dichlorobenzene	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	1310	-	(2)	-	No; not detected
1,4-Dichlorobenzene	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	310	-	(2)	-	No; not detected
2,2'-Oxybis(1-Chloropropane)	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	-	-		-	No; not detected
2,4,5-Trichlorophenol	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	-	-		-	No; not detected
2,4,6-Trichlorophenol	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	200	-	(2)	-	No; not detected
2,4-Dichlorophenol	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	80	-	(2)	-	No; not detected
2,4-Dimethylphenol	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	300	-	(2)	-	No; not detected
2,4-Dinitrophenol	2.30E+00	4.90E+00	NA	NA	0/7	NA	NA	-	-	-	6.21	-	(2)	-	No; not detected
2,4-Dinitrotoluene	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	10	-	(2)	-	No; not detected
2,6-Dinitrotoluene	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	30	-	(2)	-	No; not detected
2-Chloronaphthalene	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	410	-	(2)	-	No; not detected
2-Chlorophenol	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	30	-	(2)	-	No; not detected
2-Methylnaphthalene	4.90E-01	1.00E+00	93	93	1/7	93	93	-	-	-	20	-	(2)	4.65	Yes; HQ>1
2-Methylphenol	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	50	-	(2)	-	No; not detected
2-Nitroaniline	2.30E+00	4.90E+00	NA	NA	0/7	NA	NA	-	-	-	-	-		-	No; not detected
2-Nitrophenol	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	-	-		-	No; not detected
3,3'-Dichlorobenzidine	2.30E+00	4.90E+00	NA	NA	0/7	NA	NA	-	-	-	120		(2)	-	No; not detected
3-Nitroaniline	2.30E+00	4.90E+00	NA	NA	0/7	NA	NA	-	-	-	-	-		-	No; not detected
4,6-Dinitro-2-methylphenol	2.30E+00	4.90E+00	NA	NA	0/7	NA	NA	-	-	-	104	-	(2)	-	No; not detected
4-Bromophenyl phenyl ether	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	1550	-	(2)	-	No; not detected
4-Chloro-3-methylphenol	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	-	-		-	No; not detected
4-Chloroaniline	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	140		(2)	-	No; not detected
4-Chlorophenyl phenyl ether	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	-	-		-	No; not detected
4-Methylphenol	4.90E-01	1.00E+00	99	240	2/7	169	240	-	-	-	20	-	(2)	12.00	Yes; HQ>1
4-Nitroaniline	2.30E+00	4.90E+00	NA	NA	0/7	NA	NA	-	-	-	-	-		-	No; not detected
4-Nitrophenol	2.30E+00	4.90E+00	NA	NA	0/7	NA	NA	-	-	-	10	-	(2)	-	No; not detected
Acenaphthene	4.90E-01	1.00E+00	89	89	1/7	89	89	-	-	-	6.7	-	(2)	11.94	Yes; HQ>1
Acenaphthylene	4.90E-01	1.00E+00	200	200	1/7	200	200	-	-	-	5.9	-	(2)	33.90	Yes; HQ>1
Anthracene	4.90E-01	1.00E+00	26	330	6/7	136	330	57.2	451	845	-	-	(1)	5.77	Yes; HQ>1
Benz[a]anthracene	4.90E-01	1.00E+00	170	960	7/7	463	960	108	575	1050	-	-	(1)	8.89	Yes; HQ>1
Benzo[a]pyrene	4.90E-01	1.00E+00	190	910	7/7	451	910	150	908	1450	-	-	(1)	6.07	Yes; HQ>1
Benzo[b]fluoranthene	4.90E-01	1.00E+00	240	1100	7/7	571	1100	-	-	-	10400	-	(2)	0.11	Yes; HQ>1
Benzo[ghi]perylene	4.90E-01	1.00E+00	110	660	7/7	304	660	-	-	-	170	-	(2)	3.88	Yes; HQ>1
Benzo[k]fluoranthene	4.90E-01	1.00E+00	120	570	7/7	264	570	-	-	-	240	-	(2)	2.38	Yes; HQ>1
bis(2-Chloroethoxy)methane	4.90E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	-	-		-	No; not detected

Table 4-2 cont.
Summary of Sediment Data (Ecological)

Chemical Recovery Systems Superfund Site
Elyria, Lorain County, Ohio

SUMMARY OF SEDIMENT DATA

Contaminant of Interest	Range of Detection Limits		Range of Detected Concentrations		Frequency of Detection	Arithmetic Average of Detected Concentrations	Exposure Point Concentration	Screening Benchmarks and Reference[1]						HQ	PECOC Decision
	Minimum	Maximum	Minimum	Maximum				TEC	MEC	PEC	Region 5 ESL	Other	Reference		
bis(2-Chloroethyl) ether	4.00E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	3520	-	(2)	-	No, not detected
bis(2-Ethylhexyl) phthalate	4.00E-01	1.00E+00	69	590	1/7	590	590	-	-	-	182	-	(2)	3.24	Yes; HQ>1
Butyl benzyl phthalate	4.00E-01	1.00E+00	200	200	1/7	200	200	-	-	-	1970	-	(2)	0.10	No, below benchmark value
Carbazole	4.00E-01	1.00E+00	50	180	5/7	95.4	180	-	-	-	-	-		-	Yes; benchmark not available
Chrysene	4.00E-01	1.00E+00	210	960	7/7	500	960	166	728	1290	-	-	(1)	5.78	Yes; HQ>1
Dibenz(a,h)anthracene	4.00E-01	1.00E+00	52	150	5/7	90.2	150	-	-	-	33	-	(2)	4.55	Yes; HQ>1
Dibenzofuran	4.00E-01	1.00E+00	79	79	1/7	79	79	-	-	-	-	150	(5)	0.52	No; HQ<1
Diethyl phthalate	4.00E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	-	610	(5)	-	No, not detected
Dimethyl phthalate	4.00E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	530	-	(2)	-	No, not detected
Di-n-butyl phthalate	4.00E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	-	2200	(5)	-	No, not detected
Di-n-octyl phthalate	4.00E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	-	580	(5)	-	No, not detected
Fluoranthene	4.00E-01	1.00E+00	400	2400	7/7	1100	2400	423	1327	2230	-	-	(1)	5.67	Yes; HQ>1
Fluorene	4.00E-01	1.00E+00	31	190	5/7	90.3	190	77.4	307	536	-	-	(1)	2.46	Yes; HQ>1
Hexachlorobenzene	4.00E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	20	-	(2)	-	No, not detected
Hexachlorobutadiene	4.00E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	27	-	(2)	-	No, not detected
Hexachlorocyclopentadiene	2.00E+00	4.00E+00	NA	NA	0/7	NA	NA	-	-	-	900	-	(2)	-	No, not detected
Hexachloroethane	4.00E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	580	-	(2)	-	No, not detected
Indeno(1,2,3-cd)pyrene	4.00E-01	1.00E+00	100	570	1/7	270	570	-	-	-	200	-	(2)	2.85	Yes; HQ>1
Isophorone	4.00E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	1430	-	(2)	-	No, not detected
Naphthalene	4.00E-01	1.00E+00	59	75	2/7	74	75	176	369	561	-	-	(1)	0.45	No; HQ<1
Nitrobenzene	4.00E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	140	-	(2)	-	No, not detected
N-Nitroso-di-n-propylamine	4.00E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	-	-		-	No, not detected
N-Nitrosodiphenylamine	4.00E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	-	110	(5)	-	No, not detected
Pentachlorophenol	4.00E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	23000	-	(2)	-	No, not detected
Phenanthrene	4.00E-01	1.00E+00	220	1700	7/7	710	1700	204	687	1170	-	-	(1)	8.33	Yes; HQ>1
Phenol	4.00E-01	1.00E+00	NA	NA	0/7	NA	NA	-	-	-	40	-	(2)	-	No, not detected
Pyrene	4.00E-01	1.00E+00	330	2500	7/7	950	2500	195	858	1520	-	-	(1)	12.82	Yes; HQ>1

NA = Not Applicable
[1] Screening benchmark values are from:
(1) TEC - Threshold Effects Concentration, PEC - Probable Effects Concentration, MEC - Midpoint Value between TEC and PEC, from the Risk Assessment Information System, an on-line database maintained by the U.S. Department of Energy, Oak Ridge National Laboratory and the University of Tennessee. Available on-line at http://risk.lsd.ornl.gov/.
(2) Ecological Screening Levels (ESLs) from U.S. EPA Region 5, 2003.
(3) NOAA Effects Range Low (ERL) concentration. Obtained from the Risk Assessment Information System.
(4) Ontario Ministry of the Environment "Low" effects concentration. Obtained from the Risk Assessment Information System.
(5) Washington No Effects Level (NEL) concentration for freshwater. Obtained from the Risk Assessment Information System.

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Table 4-3
Summary of Surface Water Data (Ecological)

Chemical Recovery Systems Superfund Site
Elyria, Lorain County, Ohio

SUMMARY OF SURFACE WATER DATA

Contaminant of Interest	Range of Detection Limits		Range of Detected Concentrations		Frequency of Detection	Arithmetic Average of Detected Concentrations	Exposure Point Concentration	Screening Benchmark and Reference[1]		HQ	PECOC Decision
	Minimum	Maximum	Minimum	Maximum							
TAL Metals Method SW 846 6010B (mg/L)[2]											
Aluminum	0.05	0.05	0.231	0.619	7/7	0.404	0.619	78	(3)	0.01	No; HQ<1
Antimony	0.002	0.002	0.00012	0.0013	3/7	0.00084	0.0013	0.19	(1)	0.01	No; HQ<1
Arsenic	0.005	0.005	0.0023	0.0026	7/7	0.00241	0.0026	0.15	(1)	0.02	No; HQ<1
Barium	0.001	0.001	0.036	0.0401	7/7	0.0389	0.0401	0.22	(1)	0.18	No; HQ<1
Beryllium	0.001	0.001	NA	NA	0/7	NA	NA	44.8	(1)	-	No; not detected
Cadmium	0.001	0.001	0.000093	0.00019	7/7	0.000138	0.00019	0.00488	(1)	0.04	No; HQ<1
Calcium	2.5	2.5	49.3	53.9	7/7	51.3	53.9	-	-	-	No; essential nutrient
Chromium	0.002	0.002	0.00038	0.0011	3/7	0.000633	0.0011	0.176	(1)	0.01	No; HQ<1
Cobalt	0.001	0.001	0.00043	0.00071	7/7	0.000509	0.00071	0.024	(1)	0.03	No; HQ<1
Copper	0.002	0.002	0.0038	0.0047	7/7	0.00427	0.0047	0.0196	(1)	0.24	No; HQ<1
Iron	0.02	0.02	0.542	1.14	7/7	0.789	1.14	1	(4)	1.14	Yes; HQ>1
Lead	0.001	0.001	0.0077	0.0011	7/7	0.000917	0.0011	0.0195	(1)	0.06	No; HQ<1
Magnesium	0.5	0.5	13.5	14.1	7/7	13.7	14.1	647	(3)	0.02	No; essential nutrient
Manganese	0.001	0.001	0.0489	0.0708	7/7	0.0588	0.0708	0.12	(4)	0.59	No; HQ<1
Mercury	0.0002	0.0002	NA	NA	0/7	NA	NA	0.00091	(1)	-	No; HQ<1
Nickel	0.002	0.002	0.0032	0.037	7/7	0.0085	0.037	0.109	(1)	0.34	No; HQ<1
Potassium	5	5	0.37	0.81	7/7	0.61	0.81	-		-	No; essential nutrient
Selenium	0.005	0.005	0.00074	0.00074	1/7	0.00074	0.00074	0.005	(1)	0.15	No; HQ<1
Silver	0.001	0.001	NA	NA	0/7	NA	NA	0.0013	(1)	-	No; not detected
Sodium	5	5	21.1	25.5	7/7	22.5	25.5	-		-	No; essential nutrient
Thallium	0.001	0.001	0.000016	0.000016	1/7	0.000016	0.000016	0.017	(1)	0.00	No; HQ<1
Vanadium	0.02	0.02	0.00049	0.0014	7/7	0.00102	0.0014	0.044	(1)	0.03	No; HQ<1
Zinc	0.01	0.01	0.0068	0.0119	7/7	0.00876	0.0119	0.25	(1)	0.05	No; HQ<1
PCBs Method SW 846 8082 (ug/L)											
Aroclor 1016	1	1	NA	NA	0/14	NA	NA	0.00012	(1)	-	No; not detected
Aroclor 1221	1	1	NA	NA	0/14	NA	NA	0.00012	(1)	-	No; not detected
Aroclor 1232	1	1	NA	NA	0/14	NA	NA	0.00012	(1)	-	No; not detected
Aroclor 1242	1	1	NA	NA	0/14	NA	NA	0.00012	(1)	-	No; not detected
Aroclor 1248	1	1	NA	NA	0/14	NA	NA	0.00012	(1)	-	No; not detected
Aroclor 1254	1	1	NA	NA	0/14	NA	NA	0.00012	(1)	-	No; not detected
Aroclor 1260	1	1	NA	NA	0/14	NA	NA	0.00012	(1)	-	No; not detected
VOCs Method SW 846 8260B (ug/L)											
1,1,1-Trichloroethane	1	1	NA	NA	0/7	NA	NA	70	(1)	-	No; not detected
1,1,2,2-Tetrachloroethane	1	1	NA	NA	0/7	NA	NA	200	(1)	-	No; not detected
1,1,2-Trichloroethane	1	1	NA	NA	0/7	NA	NA	740	(1)	-	No; not detected
1,1-Dichloroethene	1	1	NA	NA	0/7	NA	NA	410	(1)	-	No; not detected
1,1-Dichloroethene	1	1	NA	NA	0/7	NA	NA	210	(1)	-	No; not detected
1,2-Dichloroethane	1	1	NA	NA	0/7	NA	NA	2000	(1)	-	No; not detected
1,2-Dichloroethene (total)	1	1	NA	NA	0/7	NA	NA	970	(1)	-	No; not detected
1,2-Dichloropropane	1	1	NA	NA	0/7	NA	NA	520	(1)	-	No; not detected
2-Butanone	10	10	NA	NA	0/7	NA	NA	22000	(1)	-	No; not detected
2-Hexanone	10	10	NA	NA	0/7	NA	NA	99	(2)	-	No; not detected
4-Methyl-2-pentanone	10	10	NA	NA	0/7	NA	NA	170	(2)	-	No; not detected
Acetone	10	10	0.89	1.9	7/7	1.27	1.9	78000	(3)	0.00	No; HQ<1
Benzene	1	1	NA	NA	0/7	NA	NA	160	(1)	-	No; not detected
Bromodichloromethane	1	1	NA	NA	0/7	NA	NA	340	(1)	-	No; not detected
Bromoform	1	1	NA	NA	0/7	NA	NA	230	(1)	-	No; not detected
Bromomethane	1	1	NA	NA	0/7	NA	NA	10	(1)	-	No; not detected
Carbon disulfide	1	1	NA	NA	0/7	NA	NA	15	(1)	-	No; not detected

Table 4-3 cont.
Summary of Surface Water Data (Ecological)

SUMMARY OF SURFACE WATER DATA

Contaminant of Interest	Range of Detection Limits		Range of Detected Concentrations		Frequency of Detection	Arithmetic Average of Detected Concentrations	Exposure Point Concentration	Screening Benchmark and Reference[1]		HQ	PECOC Decision
	Minimum	Maximum	Minimum	Maximum							
Carbon tetrachloride	1	1	NA	NA	0/7	NA	NA	240	(1)	-	No, not detected
Chlorobenzene	1	1	NA	NA	0/7	NA	NA	47	(1)	-	No, not detected
Chloroethane	1	1	NA	NA	0/7	NA	NA	200000	(3)	-	No, not detected
Chloroform	1	1	0.22	0.26	5/7	0.24	0.26	140	(1)	0.00	No, HQ<1
Chloromethane	1	1	NA	NA	0/7	NA	NA	55000	(4)	-	No, not detected
cis-1,2-Dichloroethene	0.5	0.5	NA	NA	0/7	NA	NA	970	(1)	-	No, not detected
cis-1,3-Dichloropropene	1	1	NA	NA	0/7	NA	NA	1.7	(1)	-	No, not detected
Dibromochloromethane	1	1	NA	NA	0/7	NA	NA	330	(1)	-	No, not detected
Ethylbenzene	1	1	0.2	0.36	2/7	0.23	0.36	61	(1)	0.00	No, HQ<1
Methylene chloride	1	1	NA	NA	0/7	NA	NA	1900	(1)	-	No, not detected
Styrene	1	1	NA	NA	0/7	NA	NA	32	(1)	-	No, not detected
Tetrachloroethene	1	1	NA	NA	0/7	NA	NA	53	(1)	-	No, not detected
Toluene	1	1	0.24	0.89	6/7	0.518	0.89	62	(1)	0.01	No, HQ<1
trans-1,2-Dichloroethene	0.5	0.5	NA	NA	0/7	NA	NA	970	(1)	-	No, not detected
trans-1,3-Dichloropropene	1	1	NA	NA	0/7	NA	NA	1.7	(1)	-	No, not detected
Trichloroethene	1	1	NA	NA	0/7	NA	NA	220	(1)	-	No, not detected
Vinyl chloride	1	1	NA	NA	0/7	NA	NA	930	(1)	-	No, not detected
Xylenes (total)	1	1	0.15	1.8	3/7	1.01	1.8	27	(1)	0.05	No, HQ<1
SVOCs Method SW 846 8270C (ug/L)											
1,2,4-Trichlorobenzene	10	10	NA	NA	0/7	NA	NA	30	(2)	-	No, not detected
1,2-Dichlorobenzene	10	10	NA	NA	0/7	NA	NA	23	(1)	-	No, not detected
1,3-Dichlorobenzene	10	10	NA	NA	0/7	NA	NA	22	(1)	-	No, not detected
1,4-Dichlorobenzene	10	10	NA	NA	0/7	NA	NA	9.4	(1)	-	No, not detected
2,2'-Oxybis(1-Chloropropane)	10	10	NA	NA	0/7	NA	NA	-		-	No, not detected
2,4,5-Trichlorophenol	10	10	NA	NA	0/7	NA	NA	-		-	No, not detected
2,4,6-Trichlorophenol	10	10	NA	NA	0/7	NA	NA	4.9	(1)	-	No, not detected
2,4-Dichlorophenol	10	10	NA	NA	0/7	NA	NA	11	(1)	-	No, not detected
2,4-Dimethylphenol	10	10	NA	NA	0/7	NA	NA	15	(1)	-	No, not detected
2,4-Dinitrophenol	50	50	NA	NA	0/7	NA	NA	19	(3)	-	No, not detected
2,4-Dinitrotoluene	10	10	NA	NA	0/7	NA	NA	44	(1)	-	No, not detected
2,6-Dinitrotoluene	10	10	NA	NA	0/7	NA	NA	81	(1)	-	No, not detected
2-Chloronaphthalene	10	10	NA	NA	0/7	NA	NA	0.366	(3)	-	No, not detected
2-Chlorophenol	10	10	NA	NA	0/7	NA	NA	32	(1)	-	No, not detected
2-Methylnaphthalene	10	10	NA	NA	0/7	NA	NA	330	(2)	-	No, not detected
2-Methylphenol	10	10	NA	NA	0/7	NA	NA	67	(1)	-	No, not detected
2-Nitroaniline	50	50	NA	NA	0/7	NA	NA	-		-	No, not detected
2-Nitrophenol	10	10	NA	NA	0/7	NA	NA	72	(1)	-	No, not detected
3,3'-Dichlorobenzidine	50	50	NA	NA	0/7	NA	NA	4.5	(2)	-	No, not detected
3-Nitroaniline	50	50	NA	NA	0/7	NA	NA	-		-	No, not detected
4,6-Dinitro-2-methylphenol	50	50	NA	NA	0/7	NA	NA	23	(2)	-	No, not detected
4-Bromophenylphenyl ether	10	10	NA	NA	0/7	NA	NA	1.5	(3)	-	No, not detected
4-Chloro-3-methylphenol	10	10	NA	NA	0/7	NA	NA	-		-	No, not detected
4-Chloroaniline	10	10	NA	NA	0/7	NA	NA	232	(3)	-	No, not detected
4-Chlorophenylphenyl ether	10	10	NA	NA	0/7	NA	NA	-		-	No, not detected
4-Methylphenol	10	10	NA	NA	0/7	NA	NA	53	(1)	-	No, not detected
4-Nitroaniline	50	50	NA	NA	0/7	NA	NA	-		-	No, not detected
4-Nitrophenol	50	50	NA	NA	0/7	NA	NA	60	(3)	-	No, not detected
Acenaphthene	10	10	NA	NA	0/7	NA	NA	15	(1)	-	No, not detected
Acenaphthylene	10	10	NA	NA	0/7	NA	NA	13	(1)	-	No, not detected
Anthracene	10	10	NA	NA	0/7	NA	NA	0.02	(1)	-	No, not detected
Benz(a)anthracene	10	10	NA	NA	0/7	NA	NA	4.7	(1)	-	No, not detected

Table 4-3 cont.
Summary of Surface Water Data (Ecological)

Chemical Recovery Systems Superfund Site
Elyria, Lorain County, Ohio

SUMMARY OF SURFACE WATER DATA

Contaminant of Interest	Range of Detection Limits		Range of Detected Concentrations		Frequency of Detection	Arithmetic Average of Detected Concentrations	Exposure Point Concentration	Screening Benchmark and Reference[1]		HQ	PECOC Decision
	Minimum	Maximum	Minimum	Maximum							
Benzo(a)pyrene	10	10	NA	NA	0/7	NA	NA	0.05	(1)	-	No; not detected
Benzo(b)fluoranthene	10	10	NA	NA	0/7	NA	NA	2.6	(1)	-	No; not detected
Benzo(ghi)perylene	10	10	NA	NA	0/7	NA	NA	7.64	(2)	-	No; not detected
Benzo(k)fluoranthene	10	10	NA	NA	0/7	NA	NA	-		-	No; not detected
bis(2-Chloroethoxy)methane	10	10	NA	NA	0/7	NA	NA	-		-	No; not detected
bis(2-Chloroethyl) ether	10	10	NA	NA	0/7	NA	NA	19000	(3)	-	No; not detected
bis(2-Ethylhexyl)phthalate	10	10	0.53	1.8	2/7	1.17	1.8	8.4	(1)	0.21	No; HQ<1
Butyl benzyl phthalate	10	10	NA	NA	0/7	NA	NA	25	(1)	-	No; not detected
Carbazole	10	10	NA	NA	0/7	NA	NA	-		-	No; not detected
Chrysene	10	10	NA	NA	0/7	NA	NA	4.7	(1)	-	No; not detected
Dibenz(a,h)anthracene	10	10	NA	NA	0/7	NA	NA	4	(3)	-	No; not detected
Dibenzofuran	10	10	NA	NA	0/7	NA	NA	4	(1)	-	No; not detected
Diethyl phthalate	10	10	0.46	0.52	2/7	0.49	0.52	220	(1)	0.00	No; HQ<1
Dimethyl phthalate	10	10	NA	NA	0/7	NA	NA	1100	(1)	-	No; not detected
Di-n-butyl phthalate	10	10	0.43	0.43	1/7	0.43	0.43	3	(3)	0.14	No; HQ<1
Di-n-octyl phthalate	10	10	NA	NA	0/7	NA	NA	22	(4)	-	No; not detected
Fluoranthene	10	10	NA	NA	0/7	NA	NA	0.8	(1)	-	No; not detected
Fluorene	10	10	NA	NA	0/7	NA	NA	19	(1)	-	No; not detected
Hexachlorobenzene	10	10	NA	NA	0/7	NA	NA	0.00073	(3)	-	No; not detected
Hexachlorobutadiene	10	10	NA	NA	0/7	NA	NA	0.053	(3)	-	No; not detected
Hexachlorocyclopentadiene	50	50	NA	NA	0/7	NA	NA	77	(3)	-	No; not detected
Hexachloroethane	10	10	NA	NA	0/7	NA	NA	8	(3)	-	No; not detected
Indeno(1,2,3-cd)pyrene	10	10	NA	NA	0/7	NA	NA	4.31	(3)	-	No; not detected
Isophorone	10	10	NA	NA	0/7	NA	NA	920	(1)	-	No; not detected
Naphthalene	10	10	NA	NA	0/7	NA	NA	21	(1)	-	No; not detected
Nitrobenzene	10	10	NA	NA	0/7	NA	NA	380	(1)	-	No; not detected
N-Nitrosodi-n-propylamine	10	10	NA	NA	0/7	NA	NA	20	(4)	-	No; not detected
N-Nitrosodiphenylamine	10	10	NA	NA	0/7	NA	NA	580	(4)	-	No; not detected
Pentachlorophenol	10	10	NA	NA	0/7	NA	NA	16	(1)	-	No; not detected
Phenanthrene	10	10	NA	NA	0/7	NA	NA	2.3	(1)	-	No; not detected
Phenol	10	10	NA	NA	0/7	NA	NA	400	(1)	-	No; not detected
Pyrene	10	10	NA	NA	0/7	NA	NA	4.6	(1)	-	No; not detected

NA = Not Applicable

(1) Screening benchmark values are from Ohio Environmental Protection Agency, Division of Surface Water, Outside Mixing Zone Average for the Lake Erie Drainage Basin, Effective 09/05/04, unless otherwise specified.

(2) Metals are total metals unless otherwise specified and a hardness of 239 mg/L of $CaCO_3$ was used based on OEPA sampling data.

(3) Benchmark value from USEPA, Region 5 Ecological Screening Level Surface Water Benchmark.

(4) Benchmark value from USEPA, Region 6 Freshwater Surface Water Screening Benchmark.

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2.7.2.1.1 Identification of COPEC for Surface Soils

In accordance with the approved work plan, only surface soils (defined as soils 0 to 4 feet below ground surface (bgs)) were considered in this preliminary ecological risk assessment. The 0-4 feet depth range was used since the near surface soils at the CRS Site have been altered by the varied construction and razing of buildings since the 1800s and in order to be protective of burrowing animals and vegetation, which might encounter soils up to 4 feet bgs. The maximum detected value throughout the 0-4 foot depth range was used as the exposure point concentration in order to increase the conservatism of the exposure assessment.

For surface soils, the maximum detected concentrations were compared to the lowest and most current soil benchmark values that are considered to be protective of potential terrestrial receptors (i.e., mammals, birds, plants and soil organisms). The soil screening benchmarks were obtained from a variety of sources, and, where more than one benchmark was available for a compound; the following hierarchy of values was utilized:

1. EPA Ecological Soil Screening Levels (Eco-SSLs) from EPA, 2005.

2. Ecological Screening Levels (ESLs) from EPA Region 5, August 2003.

3. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process, Efroymson, et. al., 1997.

An initial comparison to site-specific background values was not conducted since unimpacted background samples were not available to be collected from the heavily industrialized area surrounding the CRS Site. The results of the soil screening benchmark comparison identified the following compounds of potential ecological concern (COPECs, Table 1): antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, thallium, vanadium, zinc, polychlorinated biphenyls (PCBs), 1,1,1-trichloroethane, 1,1-dichloroethane, 1,2-dichloroethene (total, cis, and trans isomers), acetone, benzene, ethylbenzene, methylene chloride, tetrachloroethene, toluene, trichloroethene, vinyl chloride, xylenes, 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, carbazole, chrysene, dibenzofuran, di-n-butylphthalate, naphthalene, phenanthrene, and pyrene.

Although the calculated HQ was greater than one for aluminum, aluminum was not identified as a COPEC in soil since the CRS Site soil pH is approximately 8. According to EPA's guidance, aluminum should not be toxic at pH greater than 5.5 (EPA, 2005).

Additionally, the following compounds had calculated HQs greater than one, but they were detected at a frequency of 3% or less, therefore, they were eliminated as COPECs since they are not considered to be potentially bioaccumulative compounds: chloroethane, trans-1,3 dichloropropene, 2,4-dimethylphenol, and pentachlorophenol.

2.7.2.1.2 Identification of COPEC in Sediments

For sediments, the maximum detected concentrations from seven sample locations were compared to sediment benchmark values that are considered to be protective of ecological receptors. The sediment screening benchmarks were obtained from the Risk Assessment Information System (RAIS), an on-line database of ecological screening values maintained by the U.S. Department of Energy, Oak Ridge National Laboratory and the University of Tennessee. The database contains a number of sediment screening benchmarks and for this SLERA, the Threshold Effects Concentration (TEC), Probable Effects Concentration (PEC) and a Midpoint Effects Concentration (MEC) were used for comparison to the maximum detected CRS Site concentration. Chemicals that exceeded the TEC (the lowest concentration at which effects were first observed) were considered to be COPECs in sediment. The TEC is considered an appropriate screening benchmark since it is representative of a concentration that is unlikely to be toxic to benthos (bottom dweller organisms); however, the MEC or PEC is also presented in Table 2 for comparison purposes. If a TEC was unavailable for a compound, then the Region 5 ESL for sediments was used as an alternate screening value.

The results of the sediment screening benchmark comparison identified the following compounds as COPECs because their maximum detected concentrations exceeded the TEC: antimony, cadmium, copper, lead, manganese, nickel, zinc, Arochlor-1242, Arochlor-1254, Arochlor-1260, acetone, bromomethane, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g. h, i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dibenzo(ah)anthracene, fluoranthene, fluorene, indeno(123-cd)pyrene, phenanthrene, and pyrene. Of these COPECs, only the following five compounds also exceeded their respective PECs: acenaphthylene, dibenzo(a, h)anthracene, fluoranthene, phenanthrene, and pyrene. These exceedances are not thought to be significant since PAHs are common contaminants in the Black River watershed due to non-point run-off from road surfaces and air deposition from combustion sources (i.e., car and truck exhaust, smokestack emissions and wood-burning fires (ATSDR, 1995)).

Seven additional compounds detected in sediments were also conservatively identified as COPECs since screening benchmarks values are unavailable for these compounds: aluminum, barium, beryllium, vanadium, chloroethane, chloromethane, and carbazole. Since these compounds all have a low potential to bioaccumulate in aquatic systems, these detections are not thought to be significant.

2.7.2.1.3 Identification of COPEC for Surface Water

Surface water samples collected from seven locations (the data are presented in Appendix D of the RI report) were compared to the most current surface water benchmarks that have been adjusted for hardness and pH, as applicable and in accordance with Ohio EPA protocols, according to the following hierarchy:

1 Ohio EPA, Division of Surface Water, Outside the Mixing Zone Average, August 5, 2004.

2 U.S. EPA Region 5 Ecological Surface Water Benchmark, 2003.

3 U.S. EPA Region 6 Freshwater Surface Water Screening Benchmark, 2001.

Hardness values for the East Branch Black River were obtained from sampling done by Ohio EPA within a 5-mile stretch near the CRS Site from 1982 to 2001. Hardness ranged from 106 – 452 mg/L as $CaCO_3$ and the median value of 239 mg/L was used to adjust the surface water benchmarks, when applicable for total metals. Values for pH were also obtained from water samples collected by the Ohio EPA from the East Branch Black River from 1976 through 1997. The pH range for the East Branch Black River is 6.6 – 9.2 and the median value of 8 was used to adjust the surface water benchmarks, when applicable. The results of this comparison show that only iron were identified as a COPEC in surface water (Table 3). Iron was detected at a maximum concentration of 1.14 mg/L and the screening benchmark for iron is 1 mg/L. This exceedance is not thought to be significant since only one surface water sample was above this benchmark and the average detected surface water concentration for iron is 0.789 mg/L.

In addition to collecting surface water samples from the East Branch Black River, a water sample was collected from one of the westernmost outfall pipes in April 2005. The results of this sampling showed that all detected constituents are below applicable surface water quality standards except for selenium and 1,1,1-trichloroethane. Selenium was detected at a concentration of 12.1 µg/L and 1,1,1-trichloroethane was detected at a concentration of 200 µg/L (the surface water quality standard for selenium is 5 µg/L and the standard for 1,1,1-trichloroethane is 76 µg/L). Neither of these exceedances is thought to be significant since the samples were collected from the end of a pipe and the standards are based on concentrations outside of the mixing zone. Therefore, the concentrations of these constituents would be greatly diluted once mixed with the water in the East Branch Black River and would likely be below the established surface water criteria.

2.7.2.1.4 Identification of COPECs in Groundwater

Groundwater was eliminated as a potential medium of concern since current guidance states that ecological receptors generally will not contact groundwater unless it is discharged to the surface, at which time it should be evaluated as surface water. A few small potential seeps were identified at the CRS Site during a CRS Site visit conducted on 23 August 2004; however, there was no free flowing water emanating from the bedrock or slope adjacent to the river. The amount of the water produced by these potential seeps is too small to quantify or sample. Since the exposure to these potential seeps is expected to be minimal, this potential pathway was eliminated as a pathway of concern.

Terrestrial plants whose roots are in contact with groundwater present within the root zone could take up contaminants in groundwater. The root zone is defined as being within 3 feet of the ground surface. Since the shallowest depth to groundwater recorded at the CRS Site is 8.49 feet, the groundwater pathway for ecological receptors is not complete at the CRS Site and thus, was not evaluated further.

Table 5
Summary of Surface Water Data (Ecological)

TABLE 3

Chemical Recovery Systems Superfund Site
Elyria, Lorain County, Ohio

SUMMARY OF SURFACE WATER DATA

Contaminant of Interest	Range of Detection Limits		Range of Detected Concentrations		Frequency of Detection	Arithmetic Average of Detected Concentrations	Exposure Point Concentration	Screening Benchmark and Reference[1]		HQ	PECOC Decision
	Minimum	Maximum	Minimum	Maximum							
TAL Metals Method SW 846 6010B (mg/L)[2]											
Aluminum	0.05	0.05	0.231	0.619	7/7	0.404	0.619	78	(3)	0.01	No; HQ<1
Antimony	0.002	0.002	0.00012	0.0013	3/7	0.00084	0.0013	0.19	(1)	0.01	No; HQ<1
Arsenic	0.005	0.005	0.0023	0.0026	7/7	0.00241	0.0026	0.15	(1)	0.02	No; HQ<1
Barium	0.001	0.001	0.038	0.0401	7/7	0.0389	0.0401	0.22	(1)	0.18	No; HQ<1
Beryllium	0.001	0.001	NA	NA	0/7	NA	NA	44.8	(1)	-	No; not detected
Cadmium	0.001	0.001	0.000093	0.00019	7/7	0.000138	0.00019	0.00488	(1)	0.04	No; HQ<1
Calcium	2.5	2.5	49.3	53.9	7/7	51.3	53.9	-	-	-	No; essential nutrient
Chromium	0.002	0.002	0.00038	0.0011	3/7	0.000633	0.0011	0.176	(1)	0.01	No; HQ<1
Cobalt	0.001	0.001	0.00043	0.00071	7/7	0.000509	0.00071	0.024	(1)	0.03	No; HQ<1
Copper	0.002	0.002	0.0038	0.0047	7/7	0.00427	0.0047	0.0196	(1)	0.24	No; HQ<1
Iron	0.02	0.02	0.542	1.14	7/7	0.789	1.14	1	(4)	1.14	Yes; HQ>1
Lead	0.001	0.001	0.0077	0.0011	7/7	0.000917	0.0011	0.0195	(1)	0.06	No; HQ<1
Magnesium	0.5	0.5	13.5	14.1	7/7	13.7	14.1	647	(3)	0.02	No; essential nutrient
Manganese	0.001	0.001	0.0489	0.0708	7/7	0.0588	0.0708	0.12	(4)	0.59	No; HQ<1
Mercury	0.0002	0.0002	NA	NA	0/7	NA	NA	0.00091	(1)	-	No; HQ<1
Nickel	0.002	0.002	0.0032	0.037	7/7	0.0095	0.037	0.109	(1)	0.34	No; HQ<1
Potassium	5	5	6.37	6.81	7/7	6.61	6.81	-		-	No; essential nutrient
Selenium	0.005	0.005	0.00074	0.00074	1/7	0.00074	0.00074	0.005	(1)	0.15	No; HQ<1
Silver	0.001	0.001	NA	NA	0/7	NA	NA	0.0013	(1)	-	No; not detected
Sodium	5	5	21.1	25.5	7/7	22.5	25.5	-		-	No; essential nutrient
Thallium	0.001	0.001	0.000016	0.000016	1/7	0.000016	0.000016	0.017	(1)	0.00	No; HQ<1
Vanadium	0.02	0.02	0.00049	0.0014	7/7	0.00102	0.0014	0.044	(1)	0.03	No; HQ<1
Zinc	0.01	0.01	0.0066	0.0119	7/7	0.00876	0.0119	0.25	(1)	0.05	No; HQ<1
PCBs Method SW 846 8082 (ug/L)											
Aroclor 1016	1	1	NA	NA	0/14	NA	NA	0.00012	(1)	-	No; not detected
Aroclor 1221	1	1	NA	NA	0/14	NA	NA	0.00012	(1)	-	No; not detected
Aroclor 1232	1	1	NA	NA	0/14	NA	NA	0.00012	(1)	-	No; not detected
Aroclor 1242	1	1	NA	NA	0/14	NA	NA	0.00012	(1)	-	No; not detected
Aroclor 1248	1	1	NA	NA	0/14	NA	NA	0.00012	(1)	-	No; not detected
Aroclor 1254	1	1	NA	NA	0/14	NA	NA	0.00012	(1)	-	No; not detected
Aroclor 1260	1	1	NA	NA	0/14	NA	NA	0.00012	(1)	-	No; not detected
VOCs Method SW 846 8260B (ug/L)											
1,1,1-Trichloroethane	1	1	NA	NA	0/7	NA	NA	76	(1)	-	No; not detected
1,1,2,2-Tetrachloroethane	1	1	NA	NA	0/7	NA	NA	260	(1)	-	No; not detected
1,1,2-Trichloroethane	1	1	NA	NA	0/7	NA	NA	740	(1)	-	No; not detected
1,1-Dichloroethane	1	1	NA	NA	0/7	NA	NA	410	(1)	-	No; not detected
1,1-Dichloroethene	1	1	NA	NA	0/7	NA	NA	210	(1)	-	No; not detected
1,2-Dichloroethane	1	1	NA	NA	0/7	NA	NA	2000	(1)	-	No; not detected
1,2-Dichloroethene (total)	1	1	NA	NA	0/7	NA	NA	970	(1)	-	No; not detected
1,2-Dichloropropane	1	1	NA	NA	0/7	NA	NA	520	(1)	-	No; not detected
2-Butanone	10	10	NA	NA	0/7	NA	NA	22000	(1)	-	No; not detected
2-Hexanone	10	10	NA	NA	0/7	NA	NA	99	(2)	-	No; not detected
4-Methyl-2-pentanone	10	10	NA	NA	0/7	NA	NA	170	(2)	-	No; not detected
Acetone	10	10	0.89	1.9	7/7	1.27	1.9	78000	(3)	0.00	No; HQ<1
Benzene	1	1	NA	NA	0/7	NA	NA	160	(1)	-	No; not detected
Bromodichloromethane	1	1	NA	NA	0/7	NA	NA	340	(1)	-	No; not detected
Bromoform	1	1	NA	NA	0/7	NA	NA	230	(1)	-	No; not detected
Bromomethane	1	1	NA	NA	0/7	NA	NA	16	(1)	-	No; not detected
Carbon disulfide	1	1	NA	NA	0/7	NA	NA	15	(1)	-	No; not detected

Table 5 cont. Summary of Surface Water Data (Ecological)

TABLE 3

Chemical Recovery Systems Superfund Site
Elyria, Lorain County, Ohio

SUMMARY OF SURFACE WATER DATA

Contaminant of Interest	Range of Detection Limits		Range of Detected Concentrations		Frequency of Detection	Arithmetic Average of Detected Concentrations	Exposure Point Concentration	Screening Benchmark and Reference[1]		HQ	PECOC Decision
	Minimum	Maximum	Minimum	Maximum							
Carbon tetrachloride	1	1	NA	NA	0/7	NA	NA	240	(1)	-	Noc: not detected
Chlorobenzene	1	1	NA	NA	0/7	NA	NA	47	(1)	-	Noc: not detected
Chloroethane	1	1	NA	NA	0/7	NA	NA	2380000	(3)	-	Noc: not detected
Chloroform	1	1	0.22	0.28	5/7	0.24	0.28	140	(1)	0.002	Noc: HQ<1
Chloromethane	1	1	NA	NA	0/7	NA	NA	95000	(4)	-	Noc: not detected
cis-1,3-Dichloropropene	0.5	0.5	NA	NA	0/7	NA	NA	970	(1)	-	Noc: not detected
cis-1,3-Dichloropropene	1	1	NA	NA	0/7	NA	NA	1.7	(1)	-	Noc: not detected
Dibromochloromethane	1	1	NA	NA	0/7	NA	NA	220	(1)	-	Noc: not detected
Ethylbenzene	1	1	0.2	0.29	2/7	0.23	0.29	61	(1)	0.000	Noc: HQ<1
Methylene chloride	1	1	NA	NA	0/7	NA	NA	1900	(1)	-	Noc: not detected
Styrene	1	1	NA	NA	0/7	NA	NA	32	(1)	-	Noc: not detected
Tetrachloroethene	1	1	NA	NA	0/7	NA	NA	83	(1)	-	Noc: not detected
Toluene	1	1	0.24	0.89	6/7	0.518	0.89	62	(1)	0.01	Noc: HQ<1
trans-1,3-Dichloroethene	0.5	0.5	NA	NA	0/7	NA	NA	970	(1)	-	Noc: not detected
trans-1,3-Dichloropropene	1	1	NA	NA	0/7	NA	NA	1.7	(1)	-	Noc: not detected
Trichloroethene	1	1	NA	NA	0/7	NA	NA	220	(1)	-	Noc: not detected
Vinyl chloride	1	1	NA	NA	0/7	NA	NA	930	(1)	-	Noc: not detected
Xylenes (total)	1	1	0.65	1.4	3/7	1.01	1.4	27	(1)	0.05	Noc: HQ<1
SVOCs Method SW 846 8270C (ug/L)											
1,2,4-Trichlorobenzene	10	10	NA	NA	0/7	NA	NA	30	(3)	-	Noc: not detected
1,2-Dichlorobenzene	10	10	NA	NA	0/7	NA	NA	33	(1)	-	Noc: not detected
1,3-Dichlorobenzene	10	10	NA	NA	0/7	NA	NA	32	(1)	-	Noc: not detected
1,4-Dichlorobenzene	10	10	NA	NA	0/7	NA	NA	6.4	(1)	-	Noc: not detected
2,2'-Oxybis(1-Chloropropane	10	10	NA	NA	0/7	NA	NA	-		-	Noc: not detected
2,4,5-Trichlorophenol	10	10	NA	NA	0/7	NA	NA	-		-	Noc: not detected
2,4,6-Trichlorophenol	10	10	NA	NA	0/7	NA	NA	4.9	(1)	-	Noc: not detected
2,4-Dichlorophenol	10	10	NA	NA	0/7	NA	NA	11	(1)	-	Noc: not detected
2,4-Dimethylphenol	10	10	NA	NA	0/7	NA	NA	19	(1)	-	Noc: not detected
2,4-Dinitrophenol	50	50	NA	NA	0/7	NA	NA	19	(2)	-	Noc: not detected
2,4-Dinitrotoluene	10	10	NA	NA	0/7	NA	NA	44	(1)	-	Noc: not detected
2,6-Dinitrotoluene	10	10	NA	NA	0/7	NA	NA	81	(1)	-	Noc: not detected
2-Chloronaphthalene	10	10	NA	NA	0/7	NA	NA	0.399	(3)	-	Noc: not detected
2-Chlorophenol	10	10	NA	NA	0/7	NA	NA	32	(1)	-	Noc: not detected
2-Methylnaphthalene	10	10	NA	NA	0/7	NA	NA	330	(3)	-	Noc: not detected
2-Methylphenol	10	10	NA	NA	0/7	NA	NA	97	(1)	-	Noc: not detected
2-Nitroaniline	50	50	NA	NA	0/7	NA	NA	-		-	Noc: not detected
2-Nitrophenol	10	10	NA	NA	0/7	NA	NA	73	(1)	-	Noc: not detected
3,3'-Dichlorobenzidine	50	50	NA	NA	0/7	NA	NA	4.6	(3)	-	Noc: not detected
3-Nitroaniline	50	50	NA	NA	0/7	NA	NA	-		-	Noc: not detected
4,6-Dinitro-2-methylphenol	50	50	NA	NA	0/7	NA	NA	23	(3)	-	Noc: not detected
4-Bromophenyl phenyl ether	10	10	NA	NA	0/7	NA	NA	1.5	(2)	-	Noc: not detected
4-Chloro-3-methylphenol	10	10	NA	NA	0/7	NA	NA	-		-	Noc: not detected
4-Chloroaniline	10	10	NA	NA	0/7	NA	NA	232	(2)	-	Noc: not detected
4-Chlorophenyl phenyl ether	10	10	NA	NA	0/7	NA	NA	-		-	Noc: not detected
4-Methylphenol	10	10	NA	NA	0/7	NA	NA	23	(1)	-	Noc: not detected
4-Nitroaniline	50	50	NA	NA	0/7	NA	NA	-		-	Noc: not detected
4-Nitrophenol	50	50	NA	NA	0/7	NA	NA	60	(2)	-	Noc: not detected
Acenaphthene	10	10	NA	NA	0/7	NA	NA	19	(1)	-	Noc: not detected
Acenaphthylene	10	10	NA	NA	0/7	NA	NA	13	(1)	-	Noc: not detected
Anthracene	10	10	NA	NA	0/7	NA	NA	0.82	(1)	-	Noc: not detected
Benzo(a)anthracene	10	10	NA	NA	0/7	NA	NA	4.7	(1)	-	Noc: not detected

Table 5 cont. Summary of Surface Water (Ecological)

TABLE 3

Chemical Recovery Systems Superfund Site
Elyria, Lorain County, Ohio

SUMMARY OF SURFACE WATER DATA

Contaminant of Interest	Range of Detection Limits		Range of Detected Concentrations		Frequency of Detection	Arithmetic Average of Detected Concentrations	Exposure Point Concentration	Screening Benchmark and Reference[1]		HQ	PECOC Decision
	Minimum	Maximum	Minimum	Maximum							
Benzo(a)pyrene	10	10	NA	NA	0/7	NA	NA	0.05	[1]	-	No; not detected
Benzo(b)fluoranthene	10	10	NA	NA	0/7	NA	NA	2.8	[1]	-	No; not detected
Benzo(ghi)perylene	10	10	NA	NA	0/7	NA	NA	7.64	[3]	-	No; not detected
Benzo(k)fluoranthene	10	10	NA	NA	0/7	NA	NA	-		-	No; not detected
bis(2-Chloroethoxy)methane	10	10	NA	NA	0/7	NA	NA	-		-	No; not detected
bis(2-Chloroethyl) ether	10	10	NA	NA	0/7	NA	NA	19000	[3]	-	No; not detected
bis(2-Ethylhexyl)phthalate	10	10	0.83	1.8	2/7	1.17	1.8	8.4	[1]	0.21	No; HQ<1
Butyl benzyl phthalate	10	10	NA	NA	0/7	NA	NA	23	[1]	-	No; not detected
Carbazole	10	10	NA	NA	0/7	NA	NA	-		-	No; not detected
Chrysene	10	10	NA	NA	0/7	NA	NA	4.7	[1]	-	No; not detected
Dibenzo(a,h)anthracene	10	10	NA	NA	0/7	NA	NA	4	[3]	-	No; not detected
Dibenzofuran	10	10	NA	NA	0/7	NA	NA	4	[1]	-	No; not detected
Diethyl phthalate	10	10	0.48	0.52	2/7	0.49	0.52	220	[1]	0.00	No; HQ<1
Dimethyl phthalate	10	10	NA	NA	0/7	NA	NA	1100	[1]	-	No; not detected
Di-n-butyl phthalate	10	10	0.43	0.43	1/7	0.43	0.43	3	[3]	0.14	No; HQ<1
Di-n-octyl phthalate	10	10	NA	NA	0/7	NA	NA	22	[4]	-	No; not detected
Fluoranthene	10	10	NA	NA	0/7	NA	NA	0.8	[1]	-	No; not detected
Fluorene	10	10	NA	NA	0/7	NA	NA	19	[1]	-	No; not detected
Hexachlorobenzene	10	10	NA	NA	0/7	NA	NA	0.0003	[3]	-	No; not detected
Hexachlorobutadiene	10	10	NA	NA	0/7	NA	NA	0.053	[3]	-	No; not detected
Hexachlorocyclopentadiene	50	50	NA	NA	0/7	NA	NA	77	[3]	-	No; not detected
Hexachloroethane	10	10	NA	NA	0/7	NA	NA	9	[3]	-	No; not detected
Indeno(1,2,3-cd)pyrene	10	10	NA	NA	0/7	NA	NA	4.31	[3]	-	No; not detected
Isophorone	10	10	NA	NA	0/7	NA	NA	600	[1]	-	No; not detected
Naphthalene	10	10	NA	NA	0/7	NA	NA	21	[1]	-	No; not detected
Nitrobenzene	10	10	NA	NA	0/7	NA	NA	380	[1]	-	No; not detected
N-Nitrosodi-n-propylamine	10	10	NA	NA	0/7	NA	NA	20	[4]	-	No; not detected
N-Nitrosodiphenylamine	10	10	NA	NA	0/7	NA	NA	580	[4]	-	No; not detected
Pentachlorophenol	10	10	NA	NA	0/7	NA	NA	16	[1]	-	No; not detected
Phenanthrene	10	10	NA	NA	0/7	NA	NA	2.3	[1]	-	No; not detected
Phenol	10	10	NA	NA	0/7	NA	NA	400	[1]	-	No; not detected
Pyrene	10	10	NA	NA	0/7	NA	NA	4.8	[1]	-	No; not detected

NA = Not Applicable

[1] Screening benchmark values are from Ohio Environmental Protection Agency, Division of Surface Water, Outside Mixing Zone Average for the Lake Erie Drainage Basin, Effective 09/05/04, unless otherwise specified.

[2] Metals are total metals unless otherwise specified and a hardness of 239 mg/L of CaCO3 was used based on OEPA sampling data.

[3] Benchmark value from USEPA, Region 6 Ecological Screening Level Surface Water Benchmark.

[4] Benchmark value from USEPA, Region 6 Freshwater Surface Water Screening Benchmark.

2.7.2.2 Risk Characterization (Ecological)

Due to the evidence of beaver use of the CRS Site (Photograph 3) as an occasional foraging area, a separate evaluation was conducted for the potential risk to aquatic mammals, using the muskrat as the representative species for this receptor population. To determine the potential risk to this receptor, the estimated intake and risk for a muskrat was calculated as described in the following paragraphs.

Photograph 3 - Evidence of Beaver Activities

15. Signs of beaver activity on the trees along the bank of the East Branch Black River.

The following exposure parameters (from the Wildlife Exposure Factors Handbook, EPA, 1993) were used to calculate the estimated intake for the muskrat, a surrogate species for the beaver:

- Body weight (BW): 1.3 kg;
- Food ingestion rate (NFIR): 0.34 g/g-day (normalized to body weight);
- Water ingestion rate (NWIR): 0.98 g/g-day (normalized to body weight);
- Exposure duration: 365 days per year;
- Home range: < 1 acre;
- % Diet: Soil/Sediment – 9%; Vegetation – 91% (percent soil/sediment assumed to be similar to that of a raccoon);
- Fraction of Water Ingested from the East Branch Black River (FWR): 100%; and
- Fraction of Food Ingested from the CRS Site (FR): 100%.

Due to the beaver/muskrat being likely only to be exposed to contaminants present within the wooded portion of the CRS Site along East Branch Black River, only those soils, surface water and sediment samples located in this area were used to estimate intake for the muskrat. Specifically, any detections of a chemical in the following samples, at depths from 0 to 2 feet below ground surface, were used to evaluate exposure for the muskrat (Tables 6 and 6.1):

Table 6.0 Summary of Soil and Sediment Intake Used for Muskrat

TABLE 4

Chemical Recovery Systems Superfund Site
Elyria, Lorain County, Ohio

SUMMARY OF SOIL AND SEDIMENT DATA USED TO ESTIMATE INTAKE FOR THE MUSKRAT

Table 6.0 cont. Summary of Soil and Sediment Intake Used for Muskrat

TABLE 4

Chemical Recovery Systems Superfund Site
Elyria, Lorain County, Ohio

SUMMARY OF SOIL AND SEDIMENT DATA USED TO ESTIMATE INTAKE FOR THE MUSKRAT

Analyte	Region 9 PRGs Industrial (mg/kg)	HA-1 (0-0.5)	HA-2 (0-0.5)	HA-3 (0-0.5)	HA-4 (0-0.5)	HA-5 (0-0.5)	HA-6 (0-0.5)	HA-7 (0-0.5)	CP-8 (0-2)	[illegible]	[illegible]	[illegible]	SD-01	SD-02	SD-03	SD-04	SD-05	SD-05 Dup
2-Chloronaphthalene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2-Chlorophenol	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2-Methylnaphthalene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2-Methylphenol	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2-Nitroaniline	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2-Nitrophenol	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3,3'-Dichlorobenzidine	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3-Nitroaniline	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4,6-Dinitro-2-methylphenol	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4-Bromophenyl phenyl ether	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4-Chloro-3-methylphenol	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4-Chloroaniline	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4-Chlorophenyl phenyl ether	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4-Methylphenol	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4-Nitroaniline	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4-Nitrophenol	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Acenaphthene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Acenaphthylene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Anthracene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo(a)anthracene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo(a)pyrene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo(b)fluoranthene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo(g,h,i)perylene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo(k)fluoranthene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bis(2-Chloroethoxy)methane	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bis(2-Chloroethyl) ether	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bis(2-Ethylhexyl) phthalate	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Butyl benzyl phthalate	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Carbazole	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chrysene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dibenz(a,h)anthracene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dibenzofuran	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Diethyl phthalate	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dimethyl phthalate	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Di-n-butyl phthalate	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Di-n-octyl phthalate	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fluoranthene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fluorene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hexachlorobenzene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hexachlorobutadiene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hexachlorocyclopentadiene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hexachloroethane	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Indeno(1,2,3-cd)pyrene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Isophorone	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Naphthalene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Nitrobenzene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
N-Nitroso-di-n-propylamine	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
N-Nitrosodiphenylamine	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pentachlorophenol	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Phenanthrene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Phenol	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pyrene	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PCBs Method SW846 8082 (mg/kg)																		
Aroclor 1016	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Aroclor 1221	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Aroclor 1232	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Aroclor 1242	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Aroclor 1248	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Aroclor 1254	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Aroclor 1260	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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Soil: HA-1, HA-2, HA-3, HA-4, HA-5, HA-6, HA-7, GP-8, GP-44

Sediment: SD-01, SD-02, SD-03, SD-04, SD-05, SD-05 (duplicate)

Surface Water: SW-01 through SW-06

The following equations were used to calculate the intake for a muskrat:

The intake of a particular compound of concern via surface water was estimated using the following equation:

$$ADD_{pot} = C \times FWR \times NWIR \times CF$$

where:

ADD_{pot}	=	Potential Average Daily Dose (mg/kg-day)
C	=	Maximum Concentration of the Contaminant in the Surface Water (mg/L)
FWR	=	Fraction of the Total Water Ingested (percentage)
NWIR	=	Normalized Water Ingestion Rate (g/g-day)
CF	=	Conversion Factor (1 L water = 1 kg)

The intake for soil/sediment ingestion was estimated using the following equation:

$$ADD_{pot} = C \times FS \times NFIR \times FR$$

where:

ADD_{pot}	=	Potential Average Daily Dose (mg/kg-day)
C	=	Maximum Concentration of the Contaminant in the Soil/Sediment (mg/kg)
FS	=	Fraction of the Soil/Sediment in Diet (percentage)
NFIR	=	Normalized Food Ingestion Rate (g/g-day)
FR	=	Fraction of the Total Food Intake from the Area (percentage)

The fraction of the total food intake from the area is a function of the animal's home range; however, it was conservatively assumed that the muskrat obtains all of its food from the same maximally contaminated area, therefore a default value of 1.0 (100 percent) was utilized.

The intake via the ingestion of contaminated food and/or prey was estimated using the following equation:

$$ADD_{pot} = C \times FR \times NFIR$$

where:

ADD_{pot}	=	Potential Average Daily Dose (mg/kg-day)
C	=	Maximum Concentration of the Contaminant in Food (mg/kg)
FR	=	Fraction of the Intake that is Contaminated (percentage)
NFIR	=	Normalized Food Ingestion Rate (g/g-day)

The concentration of the contaminant in food was estimated based on the bioconcentration/bioaccumulation potential and various plant uptake factors for the compounds of concern. The fraction of the intake that is contaminated is a function of the animal's home range, for the screening level risk assessment, it was conservatively assumed that all food consumed is contaminated at the same level (default value of 100 percent).

Ingestion of contaminated food includes plant materials for the muskrat. The concentration of COPECs in plants can be described by the following equation:

$$C_{TP} = P_d + P_v + P_r$$

where:

C_{TP} = Concentration in plants (mg/kg)
P_d = Aboveground plant concentration due to direct deposition (mg/kg)
P_v = Aboveground plant concentration due to air-to-plant transfer (mg/kg)
P_r = Aboveground plant concentration due to root uptake (mg/kg)

The aboveground plant concentrations due to direct deposition and air-to-plant transfer are not applicable for the CRS Site since the compounds of concern are not airborne; therefore, the estimated concentration in plants would simplify to only the concentration due to root uptake.

The plant concentration resulting from root uptake is presented on Table 5 and is described by the following equation:

$$P_r = S_c\,(BCF)$$

where:

P_r = Concentration of pollutant in plant resulting from direct uptake from soil/sediment (mg/kg)
S_c = Maximum soil/sediment concentration of pollutant over exposure duration (mg/kg)
BCF_r = Plant bioconcentration factor for aboveground produce (chemical-specific)

Plant bioconcentration factors were obtained from U.S. EPA (2005), Travis and Arms (1988), Bechtel-Jacobs (1998) and Baes, et. al., (1984).

Toxicity reference values (TRVs) for the muskrat were obtained from the literature and are presented in Table 6. Where possible, NOAELs were used as the preferential TRV. In lieu of the availability of a NOAEL, other data were used with appropriate conversion factors in accordance with guidance by Ohio EPA (2003). In addition, since there are little toxicity data available directly for a muskrat, scaling factors based on body weight were used to adjust the TRVs. All adjustments are presented on Table 6.

Table 6.1 Toxicity Reference Values for the Muskrat

TABLE 6

Chemical Recovery Systems Superfund Site
Elyria, Lorain County, Ohio

TOXICITY REFERENCE VALUES (TRVs) for the Muskrat

CONSTITUENT	TRV (mg/kg-day)	STUDY BASIS	NOAEL CONVERSION FACTOR[1]	SCALING FACTOR[2]	FINAL NOAEL[3] (mg/kg-day)	REFERENCE
1,1,1-Trichloroethane	1000	Chronic NOAEL to mouse	1	0.39	390.00	Sample, 1996
1,1,2-Trichloroethane	1000	Chronic NOAEL to mouse for 1,1,1-trichloroethane	0.33	0.39	128.70	Sample, 1996
1,1-Dichloroethane	50	Chronic NOAEL to mouse for 1,2-dichloroethane	0.33	0.39	6.44	Sample, 1996
1,1-Dichloroethene	30	Chronic NOAEL to rat	1	0.72	21.60	Sample, 1996
1,2-Dichloroethene (total)	452	Subchronic NOAEL to mouse	0.33	0.39	58.17	Sample, 1996
2-Butanone	1771	Chronic NOAEL to rat	1	0.72	1275.12	Sample, 1996
4-Methyl-2-pentanone	250	Subchronic NOAEL to rat	0.33	0.72	59.40	Sample, 1996
Acetone	100	Subchronic NOAEL to rat	0.33	0.72	23.76	Sample, 1996
Benzene	263.6	Chronic LOAEL to mouse	0.1	0.39	10.28	Sample, 1996
Carbon disulfide	3188	LD50 to rat	0.0001	0.72	0.23	HSDB, 2006
Carbon tetrachloride	16	Chronic NOAEL to rat	1	0.72	11.52	Sample, 1996
Chloroethane	1800	LD50 to rat for chloromethane	0.0001	0.72	0.13	HSDB, 2005
Chloroform	150	Subchronic NOAEL to rat	0.33	0.72	35.64	Sample, 1996
Chloromethane	1800	LD50 to rat	0.0001	0.72	0.13	HSDB, 2005
cis-1,2-Dichloroethene	452	Subchronic NOAEL to mouse for 1,2-dichloroethene	0.05	0.39	8.81	Sample, 1996
Ethylbenzene	97.1	Chronic NOEL to rat for liver and kidney toxicity	1	0.72	69.91	IRIS, 1991
Methylene chloride	5.85	Chronic NOAEL to rat	1	0.72	4.21	Sample, 1996
Styrene	200	Subchronic NOAEL to dog	0.33	1.77	116.82	IRIS, 1992
Tetrachloroethene	20	Subchronic NOAEL to mouse	0.33	0.72	4.75	Sample, 1996
Toluene	259.8	Chronic LOAEL to mouse	0.1	0.39	10.13	Sample, 1996
Trichloroethene	100	Subchronic LOAEL to mouse	0.05	0.39	1.95	Sample, 1996
Vinyl chloride	1.7	Chronic LOAEL to rat	0.33	0.72	0.40	Sample, 1996
Xylenes	2.1	Chronic NOAEL to mouse	1	0.39	0.82	Sample, 1996
Aluminum	1.93	Chronic NOAEL to mouse	1	0.39	0.75	Sample, 1996
Antimony	0.125	Chronic NOAEL to mouse	1	0.39	0.05	Sample, 1996
Arsenic	1.26	Chronic LOAEL to mouse over 3 generations	0.33	0.39	0.16	Sample, 1996
Barium	5.1	Chronic NOAEL to rat	1	0.72	3.67	Sample, 1996
Beryllium	0.66	Chronic NOAEL to rat	1	0.72	0.48	Sample, 1996
Cadmium	1	Chronic NOAEL to rat	1	0.72	0.72	Sample, 1996
Chromium	2737	Chronic NOAEL to rat	1	0.72	1970.64	Sample, 1996
Cobalt	202	LD50 to rat	0.0001	0.72	0.01	RTECS, 2006
Copper	11.7	Chronic NOAEL to mink	1	0.74	8.66	Sample, 1996
Iron	360	LD50 to rat	0.0001	0.72	0.03	FDA, 1975
Lead	8	Chronic NOAEL to rat	1	0.72	5.76	Sample, 1996
Manganese	88	Chronic NOAEL to rat	1	0.72	63.36	Sample, 1996
Mercury	1	Chronic NOAEL to mink	1	0.74	0.74	Sample, 1996
Nickel	40	Chronic NOAEL to rat	1	0.72	28.80	Sample, 1996
Selenium	0.2	Chronic NOAEL to rat	1	0.72	0.14	Sample, 1996
Silver	89	Chronic LOAEL to rat	0.33	0.72	21.15	IRIS, 1996
Thallium	0.74	Subchronic LOAEL to rat	0.05	0.72	0.03	Sample, 1996
Vanadium	2.1	Chronic LOAEL to rat	0.33	0.72	0.50	Sample, 1996
Zinc	160	Chronic NOAEL to rat	1	0.72	115.20	Sample, 1996

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Table 6.1 cont. Toxicity Reference Values for the Muskrat

TABLE 6

Chemical Recovery Systems Superfund Site
Elyria, Lorain County, Ohio

TOXICITY REFERENCE VALUES (TRVs) for the Muskrat

CONSTITUENT	TRV (mg/kg-day)	STUDY BASIS	NOAEL CONVERSION FACTOR[1]	SCALING FACTOR[2]	FINAL NOAEL[3] (mg/kg-day)	REFERENCE
2-Methylnaphthalene	4.7	Chronic LOAEL to mice	0.1	0.39	0.18	IRIS, 2003
4-Methylphenol	207	LD50 to rat	0.0001	0.72	0.01	HSDB, 2006
Acenaphthene	175	Subchronic NOAEL to mouse	0.33	0.39	22.62	IRIS, 1990
Acenaphthylene	10	Chronic LOAEL to mouse for benzo(a)pyrene	0.1	0.39	0.39	Sample, 1996
Anthracene	1000	Subchronic NOEL to mice	0.33	0.39	128.70	IRIS, 1991
Benzo(a)anthracene	167	Subchronic LOAEL to mouse	0.05	0.39	3.26	USEPA, 1999
Benzo(a)pyrene	10	Chronic LOAEL to mouse	0.1	0.39	0.39	Sample, 1996
Benzo(b)fluoranthene	10	Chronic LOAEL to mouse for benzo(a)pyrene	0.1	0.39	0.39	Sample, 1996
Benzo(ghi)perylene	10	Chronic LOAEL to mouse for benzo(a)pyrene	0.1	0.39	0.39	Sample, 1996
Benzo(k)fluoranthene	10	Chronic LOAEL to mouse for benzo(a)pyrene	0.1	0.39	0.39	Sample, 1996
Bis(2-Ethylhexyl) phthalate	18.3	Chronic NOAEL to mouse	1	0.39	7.14	Sample, 1996
Butyl benzyl phthalate	13500	LD50 to rat	0.0001	0.72	0.97	HSDB, 2006
Carbazole	6000	LD50 to rat	0.0001	0.72	0.86	HSDB, 2006
Chrysene	10	Chronic LOAEL to mouse for benzo(a)pyrene	0.1	0.39	0.39	Sample, 1996
Dibenz(ah)anthracene	10	Chronic LOAEL to mouse for benzo(a)pyrene	0.1	0.39	0.39	Sample, 1996
Dibenzofuran	10	Chronic LOAEL to mouse for benzo(a)pyrene	0.1	0.39	0.39	Sample, 1996
Diethyl phthalate	4555	Chronic NOAEL to mouse	1	0.39	1787.37	Sample, 1996
Dimethyl phthalate	4555	Chronic NOAEL to mouse for diethyl phthalate	0.33	0.39	589.63	Sample, 1996
Di-n-butyl phthalate	668	Chronic NOAEL to mouse	1	0.39	214.60	Sample, 1996
Fluoranthene	125	Subchronic NOAEL to mouse	0.33	0.39	16.09	IRIS, 1990
Fluorene	125	Subchronic NOAEL to mouse	0.33	0.39	16.09	IRIS, 1990
Indeno(123-cd)pyrene	10	Chronic LOAEL to mouse for benzo(a)pyrene	0.1	0.39	0.39	Sample, 1996
Isophorone	1000	LD50 to rat	0.0001	0.72	0.07	HSDB, 2006
Naphthalene	71	Subchronic NOAEL to rat	0.33	0.72	16.87	IRIS, 1998
Pentachlorophenol	0.34	Chronic NOAEL to rat	1	0.72	0.17	Sample, 1996
Phenanthrene	10	Chronic LOAEL to mouse for benzo(a)pyrene	0.1	0.39	0.39	Sample, 1996
Pyrene	75	Subchronic NOAEL to mouse	0.33	0.39	9.65	IRIS, 1991
Aroclor 1242	0.069	Chronic NOAEL to mink	1	0.74	0.05	Sample, 1996
Aroclor 1248	0.01	Chronic NOAEL to rhesus monkey	1	1.4	0.01	Sample, 1996
Aroclor 1254	0.14	Chronic NOAEL to mink	1	0.74	0.10	Sample, 1996
Aroclor 1260	0.14	Chronic NOAEL to mink for Aroclor 1254	0.33	0.74	0.03	Sample, 1996

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Table 6.1 cont. Toxicity Reference Values for the Muskrat

TABLE 6

Chemical Recovery Systems Superfund Site
Elyria, Lorain County, Ohio

TOXICITY REFERENCE VALUES (TRVs) for the Muskrat

CONSTITUENT	TRV (mg/kg-day)	STUDY BASIS	NOAEL CONVERSION FACTOR[1]	SCALING FACTOR[2]	FINAL NOAEL[3] (mg/kg-day)	REFERENCE

(1) NOAEL conversion factors developed in accordance with Ohio EPA (2003) guidance as follows:
Chronic NOAEL to Chronic NOAEL: No conversion (i.e., multiplied by 1)
Subchronic NOAEL to Chronic NOAEL: 0.33
Chronic LOAEL to Chronic NOAEL: 0.1
Subchronic LOAEL to Chronic NOAEL: 0.05
LD50 to Chronic NOAEL: 0.0001
(2) Scaling factor is based on weight ratios as follows:
(body weight of test species / body weight of muskrat)$^{1/4}$

Species	Body Weight (kg)
Muskrat	1.3
Mouse	0.03
Rat	0.35
Mink	1
Dog	12.7
Rhesus monkey	5
Guinea pig	0.86

(3) Final NOAEL is calculated by multiplying the TRV x NOAEL Conversion Factor x Scaling Factor

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To evaluate the potential risk to the muskrat, the total estimated intake was divided by the applicable TRV. The following compounds show a potential risk to the muskrat when using the most conservative assumptions (NOAELs and maximum exposure, i.e., exposed to maximum detected concentrations of compounds and all food and soil/sediment ingested is only from the CRS Site): xylenes, aluminum, antimony, arsenic, barium, cadmium, cobalt, copper, iron, lead, manganese, nickel, selenium, thallium, vanadium, zinc, 2-methylnaphthalene, 4-methylphenol, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, indeno(123-cd)pyrene, isophorone, phenanthrene, pyrene, Aroclor-1248, Aroclor-1254 and Aroclor-1260. If LOAELs are used as the TRVs (and assuming the same maximum exposure assumptions), the following compounds show a potential risk to the muskrat: xylenes, aluminum, antimony, barium, cadmium, cobalt, copper, iron, lead, manganese,

selenium, zinc, 2-methylnaphthalene, phenanthrene, and Aroclor- 1254. The primary exposure pathways are incidental soil/sediment ingestion and ingestion of contaminated food.

2.7.2.3 Uncertainty Analysis

Risk description involves preparation of a complete summary of conclusions of the risk estimates and addresses the uncertainty, assumptions, and limitations of the risk estimate. The uncertainty analysis is an important component of the risk assessment. A qualitative analysis was made of the uncertainties associated with the screening level risk assessment (SLERA). The components of the SLERA evaluated represent the following steps: problem formulation including screening of contaminants and criteria used toxicity and exposure characterization, and characterization of risk. This analysis identifies the potential magnitude of underestimating or overestimating the potential for adverse effects to organisms.

Lines of evidence (uncertainties) evaluated include:

- Relevance of evidence to the assessment endpoints;
- Relevance of evidence to the CSM;
- Sufficiency and quality of literature toxicity data and experimental designs;
- Potential for bioaccumulation of contaminants;
- Site risk relative to background risk;
- Spatial pattern of contamination over the site (e.g., site-associated chemicals vs. those chemicals associated with storm-water runoff, etc.);
- Size of site relative to foraging area of receptors;
- Quality of habitat for receptors;
- Strength of cause/effect relationships; and
- Relative uncertainties of weight of evidence.

The uncertainty analysis and results of the SLERA are evaluated in order to determine the potential for adverse effects to significantly affect the assessment endpoint. EPA's (1998) *Guidelines for Ecological Risk Assessment* lists five criteria for evaluating adverse changes in assessment endpoints:

- Nature of effects;
- Intensity of effects;
- Spatial scale;
- Temporal scale; and
- Potential for recovery

For this SLERA, a qualitative analysis was made of the uncertainties associated with the various components of the assessment, including the problem formulation and screening of contaminants and criteria used toxicity and exposure characterization, and characterization of risk. This analysis identifies the potential magnitude of underestimating or overestimating the potential for adverse effects to organisms.

The screening criteria used for the selection of ecological COPECs were derived from various sources per EPA and Ohio EPA guidance. These criteria are recommended for screening of CRS Site contaminants and are developed by the EPA and Ohio EPA recommended

resources. Uncertainties associated with the sources and derivation of the criteria could possibly underestimate or overestimate the number of CRS Site COPECs depending on the conservatism of the criteria. An example is using hardness data for the East Branch Black River that were collected independently of the CRS Site surface water samples in order to calculate screening benchmarks for various metals.

The selection of exposure pathways is a direct result of the sampling data results. In order to determine the potential exposure to ecological receptors to site-related constituents, the presence of constituents in environmental media must first be established. The magnitude at which these constituents are present also greatly influences resulting exposure estimates. The sampling data may not represent the actual overall distribution of contamination in the media at the CRS Site, which could result in underestimation or overestimation of potential risk from identified chemicals.

However, the use of the maximum detected concentration provided conservative exposure estimates since the receptor is actually exposed to a broader range of contaminant concentrations rather than the maximum detection and it is, therefore, unlikely that the potential for underestimation of deleterious levels of contaminants has occurred. If the full extent of contamination has not been determined, and other areas of high concentration of contaminants are present but not sampled, risk could be underestimated in this study.

Exposure and toxicity information are not available for dermal or inhalation exposure for all COPECs; hence, their lack of evaluation may underestimate risk. On-site exposure of COPECs to receptors may occur via dermal and inhalation pathways. Although these exposure routes are expected to be negligible compared to exposure via direct contact, intake of contaminants from these additional pathways may occur. Therefore, the overall contaminant exposure may be underestimated.

Another source of exposure estimation uncertainty is that contamination is assumed to remain constant over time. Fate and transport mechanisms, which would result in the degradation and loss of some COPECs from the environment, may not be considered in the exposure evaluation for ecological receptors. In addition, the risk calculations are based on the maximum detected concentration, which is reflective of the maximum exposure at a single point. Exposure would occur throughout the CRS Site at various levels, including the maximum detected concentration. Thus, actual risks may be lower than those presented in the assessment. Additionally, the uptake and retention of COPECs often do not account for the depuration of COPECs from the organism's system over time.

The preliminary risk characterization step may have some degree of uncertainty regarding risk estimation and risk description. Uncertainties in the risk estimation are compounded under the assumption of dose additivity or nonadditivity for multiple substance exposure. For this assessment, it was assumed that the potential toxic effects of the COPECs were non-additive. This assumption may result in the underestimation of risk since concurrent exposure to several contaminants; particularly PCBs and PAHs might have synergistic toxic effects.

Although the relative bioavailability of contaminants at the CRS Site was assumed to be 100 percent for the SLERA, contaminants in environmental media are generally less available to biological organisms compared with the same contaminants in the experimental medium (diet, water, etc.). For example, metals in solid matrices are frequently bound to particles or complexed with other elements. These tendencies would tend to limit the bioavailability of chemicals of potential ecological concern to receptors.

Extensive scientific data now exist to support the concepts that the longer the chemicals remain in soil, (1) the less readily they are removed by solvents, including water, (2) the less available they become to microorganisms, and (3) the less toxic they become to organisms such as earthworms, and (4) the less they are ingested by organisms such as earthworms. This reduction in availability of the chemicals reduces the risk associated with their presence in the soil (Linz and Nakles, 1997).

Although the foraging factors were assumed to be one for the SLERA, the CRS Site foraging factors for many site-specific receptors, are generally less than one, i.e., the receptors only spend part of the time at the CRS Site due to either spatial or temporal factors. For example, most robins nesting in the northern United States and Canada winter in the Gulf Coast States and the Carolinas. Most northern robins leave their breeding grounds from September to November and return between February and April (EPA, 1997). Therefore, a foraging factor of 0.5 might be appropriate for migratory avian receptors based on temporal (i.e., seasonal) use of the CRS Site. Another example would be receptors with large home ranges that may spend only a portion of their time at the CRS Site due to their wide-ranging foraging habits. Thus, with the CRS Site occupying only 2.5 acres and the home range of an eastern cottontail is 7.6-acres; a resulting site-specific foraging factor for this species would be 0.32. Thus, assuming all receptors spend all of their time at the CRS Site is likely to overestimate the risk.

2.7.3 Ecological Risk Assessment Conclusion

Due to the presence of hazardous contaminants in soil, groundwater, surface water, and sediments, a SLERA was conducted. The lowest established ecological benchmarks for each medium of concern (surface water, sediments, and soil) were compared to the maximum detected concentrations of contaminants at the CRS Site.

The groundwater pathway was eliminated as a medium of concern. The depth to shallow groundwater is over eight feet, and only a few small potential seeps were identified at the CRS Site. It was determined that exposure of ecological receptors to contaminated groundwater does not exist. The sample results showed that the CRS Site surface soil is contaminated with various compounds (metals and VOCs). The SVOC, Benzo(a)pyrene, and the metal Arsenic detected in sediments at concentrations that may be harmful to ecological receptors under certain conditions (e.g. prolonged exposure in the habitat). As for Arsenic, the upstream sample concentration exceed water quality standards, therefore, it has not been determined that Arsenic is a site-related contaminant. The risk calculations are based on the maximum detected concentration, which is reflective of the maximum exposure at a single point. The remedial alternatives considered were evaluated as to their effectiveness of remediating the site to conservative ecological screening values since those are the values that were used in the SLERA.

2.7.4 Basis for Remedial Action

The response action selected in this Record of Decision is necessary to protect public health and environment from actual or threatened releases of pollutant, contaminants or hazardous substances from the CRS Site into the environment.

2.8 Remedial Action Objectives

2.8.1 Remedial Action Objective Summary

The Remedial Action Objectives presented below consist of medium specific goals for protecting human health and the environment (Table 7). Remedial action objectives presented are aimed at protecting human health and the environment specifies the following:

- The chemicals of concern;
- Exposure route(s) and receptor(s); and,
- An acceptable contaminant level or range of levels for each exposure route. For the following media:
    - Soil and Sediment: To prevent exposure to all COCs that exceed EPA's acceptable range of 1×10^{-6} to 1×10^{-4} for carcinogens, and a Hazard Index (HI) >1.0 for non-carcinogens to the juvenile trespasser, the industrial or commercial worker, and the ecological receptors.
    - Groundwater: To minimize or eliminate contaminant migration to groundwater and surface water bodies; and
    - To restore groundwater to drinking water standards established under the Safe Drinking Water Act within a reasonable time frame.

Table 7 - CRS Site Specific Remedial Action Objectives

Receptors / Pathway	Applicable Compounds	Site-Specific Target Levels (Cumulative to 1 x 10^{-4}) (mg/kg) or (mg/l)	Site-Specific Target Levels (Cumulative to 1 x 10^{-5}) (mg/kg) or (mg/l)	Site-Specific Target Levels (Cumulative to 1 x 10^{-6}) (mg/kg) or (mg/l)	Site-Specific Target Levels (Cumulative Hazard Level of 1 for a target organ) (mg/kg) or (mg/l)	Site-Specific Target Levels* (mg/kg) or (mg/l)
Future Industrial Worker (Outdoor)						
Prevent soil ingestion, inhalation and dermal contact with COC concentrations exceeding the USEPA risk range	1,2-DCA	2.7E-01	2.7E-02	2.7E-03	8.6E-01	2.7E-01
	Benzene	2.0E+00	2.0E-01	2.0E-02	7.7E+01	2.0E+00
	Chloroform	1.1E-01	1.1E-02	1.1E-03	1.3E-01	1.1E-01
	PCE	2.3E+01	2.3E+00	2.3E-01	2.9E+01	2.3E+01
	Trichloroethylene	1.4E+02	1.4E+01	1.4E+00	1.6E+02	1.4E+02
	Vinyl Chloride	4.4E-01	4.4E-02	4.4E-03	5.3E-01	4.4E-01
	Xylene	--	--	--	5.4E+02	5.4E+02
	Benzo(a)anthracene	2.2E+00	2.2E-01	2.2E-02	--	2.2E+00
	Benzo(a)pyrene	2.5E+00	2.5E-01	2.5E-02	--	2.5E+00
	Benzo(b)fluoranthene	2.9E+00	2.9E-01	2.9E-02	--	2.9E+00
	Dibenzo(a,h)anthracene	2.3E+00	2.3E-01	2.3E-02	--	2.3E+00
	Indeno(1,2,3-c,d)pyrene	2.1E+00	2.1E-01	2.1E-02	--	2.1E+00
	Aroclor 1242	2.3E+00	2.3E-01	2.3E-02	7.3E+00	2.3E+00
	Aroclor 1248	3.8E-01	3.8E-02	3.8E-03	1.2E+00	3.8E-01
	Aroclor 1254	2.0E+00	2.0E-01	2.0E-02	6.5E+00	2.0E+00
	Aroclor 1260	2.5E-01	2.5E-02	2.5E-03	7.7E-01	2.5E-01
	Arsenic	2.9E+00	2.9E-01	2.9E-02	2.6E+02	2.9E+00
Future Industrial Worker (Indoor)						
Prevent inhalation from soil volatiles in indoor air with COC concentrations exceeding the USEPA risk range and hazard level	1,1,1-Trichloroethane	--	--	--	2.3E-01	2.3E-01
	1,1,2-Trichloroethane	1.7E-03	1.7E-04	1.7E-05	1.6E-03	1.6E-03
	1,1-Dichloroethane	--	--	--	2.1E-01	2.1E-01
	1,1-Dichloroethene	--	--	--	4.1E-03	4.1E-03
	1,2-Dichloroethane	4.2E-03	4.2E-04	4.2E-05	--	4.2E-03
	Benzene	4.1E-02	4.1E-03	4.1E-04	6.4E-01	6.4E-01
	Chloroethane	4.8E-04	4.8E-05	4.8E-06	4.8E-04	4.8E-04
	Chloroform	1.6E-03	1.6E-04	1.6E-05	--	1.6E-03
Future Industrial Worker (Indoor) (cont.) Prevent inhalation from soil volatiles in indoor air with COC concentrations exceeding the USEPA risk range and hazard level	cis-1,2-Dichloroethene	--	--	--	5.8E-01	5.8E-01
	Dibromochloromethane	8.7E-04	8.7E-05	8.7E-06	8.4E-04	8.4E-04
	Ethylbenzene	--	--	--	7.8E+01	7.8E+01
	Methylene chloride	6.7E-02	6.7E-03	6.7E-04	3.7E+00	6.7E-02
	Tetrachloroethene	3.3E-01	3.3E-02	3.3E-03	3.1E-01	3.1E-01
	Toluene	--	--	--	1.8E+01	1.8E+01
	trans-1,2-Dichloroethene	--	--	--	7.3E-02	7.3E-02
	trans-1,3-Dichloropropen	7.0E-03	7.0E-04	7.0E-05	6.5E-03	6.5E-03
	Trichloroethene	1.7E+00	1.7E-01	1.7E-02	1.6E+01	1.7E+00
	Vinyl Chloride	7.0E-03	7.0E-04	7.0E-05	3.9E-01	7.0E-03
	Xylenes	--	--	--	9.4E+00	9.4E+00
	Naphthalene	--	--	--	1.9E+01	1.9E+01
Prevent inhalation from groundwater volatiles in indoor air with COC concentrations exceeding the USEPA risk range and hazard level	Benzene	2.0E-02	2.0E-03	2.0E-04	3.1E-01	2.0E-02
	cis-1,2-Dichloroethene	--	--	--	2.7E-01	2.7E-01
	Methylene chloride	1.3E-01	1.3E-02	1.3E-03	7.4E+00	1.3E-01
	Trichloroethene	7.5E-02	7.5E-03	7.5E-04	7.1E-01	7.5E-02
	Naphthalene	--	--	--	3.9E+00	3.9E+00

* Site-specific target levels - Lower Level of the 1 x 10^{-4} cumulative risk and hazard levels

Note: 1. Ecological RAOs are equivalent to the ecological screening values presented in Tables 1 through 3 in Appendix G of the RI Report. Due to the small size of the site, the lack of significant ecological receptors, and planned continued industrial use, the human health based RAOs presented above have precedence when evaluating remedial alternatives. Should more than limited excavation, or a change in land use occur, then the ecological RAOs must also be considered.

2. SSTLs were also calculated for three COCs (trichloloethylene, Aroclor 1242, and Aroclor 1254) under a future construction worker scenario. Due to the uncertainty associated with the toxicity value of trichloroethylene and the variation of construction activities, the SSTLs calculated based on 120 day/per exposure frequency over one year period are not presented in this table. See Appendix A of the FS for these SSTLs.

3. Residential RAOs are equivalent to Region 9 PRGs, however, cumulative effects should be evaluated if a residential use is to be implemented.

2.9 Description of Alternatives

Seven alternatives were developed for detailed evaluation. Common elements of all alternatives, except the No Action Alternative are listed in Section 2.9.2. Four containment alternatives were evaluated, and two excavation alternatives were evaluated. Several treatment alternatives were also evaluated during the RI/FS, and were screened out. For more information on the types of treatment alternatives considered and the reasons those alternatives were screened out, see Table 2.3 of the FS.

2.9.1 Description of Remedy Components

- Alternative 1: No Action
- Alternative 2: Soil cover over the entire site, with an impermeable synthetic membrane over the 0.5-acre of highly contaminated soil located in the NW portion of the site.
- Alternative 3: Stone cover over the entire site, with an impermeable synthetic membrane over the 0.5-acre of highly contaminated soil located in the NW portion of the CRS Site.
- Alternative 4: Asphalt cover over the entire site, with an impermeable synthetic membrane over the 0.5-acre of highly contaminated soil located in the NW portion of the CRS Site.
- Alternative 5: Concrete cover over the entire site, with an impermeable synthetic membrane over the 0.5-acre of highly contaminated soil located in the NW portion of the CRS Site.
- Alternative 6: Excavation and off-site disposal of the top four feet of highly contaminated soil (0.5-acres located in the NW portion of the CRS Site). Backfilled with clean materials and a two feet soil cover over the entire CRS Site.
- Alternative 7: Excavation and off-site disposal of the entire 2.5-acres, backfilled with clean soil.

2.9.2 Common Elements to Each Alternative (except the No Action Alternative)

- Air monitoring during construction, and application of dust control measures;
- Demolition of the Warehouse/Office building, and the "shell" of the Rodney Hunt Still building;
- Closure of the two on-site sumps;

- Appropriately re-grade and landscape the 2.5 acre CRS Site including the slope to the East Branch of the Black River; and apply erosion protection to the slope;
- Repair the sewer line;
- Install a perimeter fence (except Alternative 7);
- Implement Instuitional Controls in the form of restrictive covenants or other appropriate controls, on the property to prohibit the following:
    - Compromise to the CRS Site cover system
    - Groundwater use for potable and non-potable purposes, until restoration to Safe Drinking Water Standards is obtained for all contaminants of concern
    - Zoning to industrial/commercial only
    - Building structures on-site without EPA notification and approval.
- Additional monitoring well installations based on pre-design studies. The purpose of the additional monitoring well installation is to complete the spatial coverage of the lateral groundwater plume.
- Monitored natural attenuation of groundwater until drinking water standards are attained. The CRS Site specific monitoring and sampling plan will be developed consistent with EPA's Monitored Natural Attenuation Guidance (OWER Directive 9200.4-179). As a contingent remedy, active groundwater treatment or other innovative measures may be necessary if MNA is not occurring.
- Required to obtain Remedial Action Objectives
- Operation and Maintenance to maintain the cover system and the CRS Site fence (except for the total excavation alternative); MNA while the COCs achieve their respective MCL concentrations.

2.9.3 Individual Analysis of Each Alternative

2.9.3.1 Alternative 1 - No Action

Estimated Capital Cost: $0 *Estimated Annual O&M Cost: $0*
Estimated Present-Worth: $0 *Estimated Construction Time Frame: None*

Regulations governing the Superfund Program require that a "no action" alternative be included to establish a baseline for comparison. Under this alternative, EPA would take no action to prevent exposure to contaminated soil and groundwater.

2.9.3.1.1 Overall Protection of Human Health and the Environment

The risks would be as determined in the baseline risk assessment, and no remedial actions implemented to eliminate the risk. There is no current unacceptable risk identified for the CRS Site. All potential unacceptable risks are associated with the future scenarios.

Under the anticipated future industrial scenario, the potential exposure pathways of concern are soil ingestion, soil dermal contact, soil inhalation, and soil and groundwater volatilization to indoor air. The chemicals of concern (COCs) for soil direct contact pathways (soil ingestion, soil dermal contact, soil inhalation) identified at the CRS Site include arsenic, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, benzene, 1,2-Dichloroethane, tetrachloroethene, toluene, trichloroethylene, vinyl chloride, and xylenes. The chemicals of concern for the inhalation of soil volatiles in indoor air pathway include 1,1,1-Trichloroethane, 1,1,2-Trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichloroethane, benzene, chloroethane, chloroform, cis-1,2-dichloroethene, dibromochloromethane, ethylbenzene, methylene chloride, naphthalene, tetrachloroethene, toluene, trans-1,2-dichloroethene, trans-1,3-Dichloropropene, trichloroethylene, vinyl chloride and xylenes. The COCs for inhalation of groundwater volatiles in indoor air pathway include benzene, cis-1,2-dichloroethene, methylene chloride, naphthalene, and trichloroethylene.

Groundwater may pose unacceptable risk if potable water wells are installed at the property. If land use is changed from industrial to residential, the contaminants detected in soils and groundwater may pose an unacceptable risk to future residents. Additionally, if land use of the CRS Site is changed to another use, a specific risk assessment should be completed to evaluate the risks associated with that specific scenario.

EPA's Ecological Risk Assessment Guidance for Superfund (E-RAGS): Process for Designing and Conducting Ecological Risk Assessments was used to prepare the ecological risk assessment report for the CRS Site. The results of the ecological risk assessment indicate that there is a potential risk to ecological receptors (mostly due to direct contact with CRS Site soil and the potential for migration of soil contaminants into the adjacent East Branch Black River). Based on the evaluation conducted in the SLERA, the No Action alternative does not meet the criterion for the protection of the environment.

2.9.3.1.2 Compliance with ARARs

As no remedial action is being performed for this Alternative, it does not comply with the applicable chemical specific ARARs for COCs above target levels.

2.9.3.1.3 Long-Term Effectiveness and Permanence

This alternative provides no long-term management measures. Most of the volatile organic compounds (VOCs) and semi-volatile compounds (SVOCs) may eventually degrade and dissipate over time, however the metal COCs will not.

2.9.3.1.4 Reduction of Toxicity, Mobility, and Volume through Treatment

This alternative provides no reduction in toxicity, mobility, or volume of the COCs and PECOCs through treatment.

2.9.3.1.5 Short-Term Effectiveness

There would be no additional risks to the community, the workers, or the environment as a result of this alternative being implemented.

2.9.3.1.6 Implementability

There are no implementability concerns, since no action is being taken for this Alternative.

2.9.3.1.7 Cost

There would be no cost associated with this alternative since no action would be taken.

2.9.3.2 Alternative 2 – Soil Cover

Estimated Capital Cost $777,000 *Estimated Construction Time Frame: 3 months*
Estimated Total Present-Worth Cost: $1.34 Million + cost of new wells $179,388=$1.52Million
Estimated Annual O&M Cost: $70,000 1st 4yrs, then $50,000 Annually
Estimated Time to Achieve Remedial Action Objectives >30 years

2.9.3.2.1 Description of Alternative

This alternative consists of a soil cover that provides two feet of cover over a two-acre portion of the CRS Site to eliminate pathways of concern. The remaining 0.5 acres of the CRS Site would have a geo-synthetic cover (Figure 6) to address the additional need for an infiltration barrier cover in this more highly contaminated area. The two existing buildings would be demolished, the concrete and crushed bricks used on-site as backfill, only if sampling analysis show that the materials are clean. The wood chips and other vegetation debris in the former above ground storage tank area would be disposed of off-site. The slope to the East Branch Black River would be regraded and have erosion protection (riprap) installed.

Penetrations to the storm sewer, which is the property of the City of Elyria, would be sealed off. Repair of the storm sewer would be coordinated with the City of Elyria. The 12- inch outfall at the south side of the CRS Site would be plugged. A fence would be placed around the entire CRS Site perimeter (top of slope at River). A deed restriction would be placed on the CRS Site to limit the future use of the CRS Site to commercial/industrial type applications that meet the assumptions in the baseline risk assessment.

Groundwater contamination would eventually be reduced to drinking water standards via monitored natural attenuation.

2.9.3.2.2 Overall Protection of Human Health and the Environment

The two-foot thick soil contact cover and the geo-synthetic cover in the northwest corner of the CRS Site would be protective of human health and the environment by eliminating exposure to the contaminated soil and by reducing precipitation infiltration, and slowing subsequent leaching of COCs through the soil and into the groundwater in the northwest corner of the CRS Site.

2.9.3.2.3 Compliance with ARARs

A review was conducted to determine the regulations that are applicable or relevant and appropriate to the remediation of the CRS Site. Both federal and state environmental and public health requirements were considered. In addition, this section presents an identification of federal and state criteria, advisories, and guidance that could be used in evaluating the remedial alternatives.

2.9.3.2.3.1 Chemical Specific ARARs

No chemical specific ARARs are identified for the primary COCs associated with soil contamination. Site-specific, risk based target levels are used as the clean-up levels. The selected remedy will either eliminate exposure pathways or mitigate risks for all soil COCs above the risk based target levels.

Safe Drinking Water Act Maximum Contaminant Levels (MCLs) are relevant and appropriate chemical specific regulations for the groundwater. The groundwater is expected to be restored to MCLs under the monitored natural attenuation groundwater remedial action, although this goal will likely be difficult to reach in a reasonable timeframe with the highly contaminated soil in the NW portion of the CRS Site is left in place.

2.9.3.2.3.2 Location Specific ARARs

The activities associated with placing the various proposed cover technologies will require work adjacent to the River, and within the floodplain of this waterway. Therefore, the following are ARARs.

- Section 10 of the River and Harbors Act of 1899 (33 USC 403) prohibits the obstruction or alteration of any navigable water in the United States (i.e., the East Branch Black River). The proposed remedy will comply with this ARAR.

- Clean Water Act (CWA) of 1977 (33 USC 1344, 33 CFR 322). Section 404 of the CWA establishes limitations on work within surface waters or wetland areas. The proposed remedy will comply with this ARAR.

- Executive Order 11988 40 CFR 6: Similar to the CWA, this ARAR requires that construction activities avoid long and short term adverse

impacts associated with actions in wetlands or floodplain areas. The proposed remedy will comply with this ARAR.

2.9.3.2.3.3 Action Specific ARARs

The proposed remedial action includes the demolition and removal of existing CRS Site buildings, and the placement of a cover above the impacted soil area to prevent human exposure. Potential Action-Specific ARARs include:

- The Clean Air Act (40 CFR 61) under the National Emissions Standards for Hazardous Air Pollutants (NESHAP) regulates emissions of asbestos. The demolition of the existing CRS Site buildings will comply with this ARAR by the removal and disposal of any asbestos containing materials.

- In addition to the Clean Air Act, the State of Ohio also regulates the removal and handling of asbestos waste under OAC 3745-20. Any associated asbestos removal and disposal will comply with this ARAR.

- The State of Ohio under OAC 3745-9-10 has regulations pertaining to the sealing and abandonment of unused wells. Monitoring wells with no projected future use on site will be sealed and abandoned in accordance with this rule.

2.9.3.2.3.4 `Other Criteria or Guidelines to be considered (TBC)

- Occupational Safety and Health Act (OSHA) of 1970 (29 USC 651), and OSHA requirements for workers engaged in response or other hazardous waste operations. This TBC will be adhered to during all phases of site remedial activities.

2.9.3.2.4 Long-Term Effectiveness and Permanence

For this alternative to remain effective, the cover must be maintained. Maintenance of the soil cover to ensure protection against erosion or animal burrows would be required. Maintenance of the geo-synthetic cover to ensure the drainage layer is functioning, and the top cover soil is not eroding or animals burrowing down to the geo-synthetic would be required. Because this alternative would leave hazardous substances on-site, an EPA review would be conducted every five years to ensure the remedy continues to provide adequate protection of human health and the environment in accordance with CERCLA §121(c).

2.9.3.2.5 Reduction of Toxicity, Mobility, and Volume through Treatment

This alternative would provide minimal reduction in the toxicity or volume of the contaminated material. The contaminated soil would remain on-site and be covered by a soil cover and a geo-synthetic cover. The geo-synthetic cover would reduce mobility of the COCs in

the soil. Natural degradation would reduce the toxicity and volume of the contaminants in the groundwater via natural attenuation.

2.9.3.2.6 Short-Term Effectiveness

Dust production during the short term may be temporarily increased due to demolition activities and re-grading for cover construction. Dust generation would be minimized through dust suppression activities. Environmental impacts would be immediately eliminated upon construction of the soil and geo-synthetic covers.

2.9.3.2.7 Implementability

The soil cover and the geo-synthetic cover would be easy to construct. An estimated 11,500 cubic yards of soil would need to be brought on-site and spread across the CRS Site to create the soil cover. The geo-synthetic cover materials (geo-membrane and geo-grid drainage layer) are readily available from several suppliers. The soil cover and the soil over the geo-membrane cover would then be seeded and would be periodically maintained. Monitoring for signs of failure or need of repair would be readily accomplished. Additional future actions are not prohibited from being implemented by this action.

2.9.3.2.8 Costs

The capital cost for construction of this Alternative is estimated to be $777,000. The 30-year present net worth including an annual Operation and Maintenance (O&M) cost is $1,520,000.

2.9.3.3 Alternative 3 – Stone Cover

Estimated Capital Cost: $761,000 *Estimated Annual O&M Cost: $43,000*
Estimated Total Present-Worth Cost: $1.3 Million + cost of new wells $179,388=$1.43Million
Estimated Annual O&M Cost: $70,000 1st 4yrs, then $50,000 Annually
Estimated Construction Timeframe: 4 months
Estimated Time to Achieve Remedial Action Objectives >30 years

2.9.3.3.1 Description of Alternative

This alternative consists of a stone cover that covers the two-acre portion of the CRS Site, which can have a contact cover and would be a minimum of one-foot thick, underlain by a geo-textile fabric. The other 0.5 acres of the CRS Site would have a geo-synthetic cover (Figure 3.2, Detail 4) to address the need for an infiltration barrier cover. The two existing buildings would be demolished, the concrete and crushed bricks used on-site as backfill, only if sampling analysis show that the materials are clean. Metal, glass, and asbestos containing debris will be disposed of off-site. The wood chips and other vegetation debris in the former aboveground storage tank area would be disposed of off-site. The slope to the River would be regraded and have erosion protection (riprap) installed. Penetrations to the storm sewer, which is the property of the City of Elyria, would be sealed off. Repair of the storm sewer would be coordinated with the City of

Elyria. The 12-inch outfall at the south side of the CRS Site will be plugged. A fence would be placed around the entire CRS Site perimeter (top of slope at River). A deed restriction would be placed on the CRS Site to limit the future use of the CRS Site to commercial/industrial type applications that meet the assumptions in the baseline risk assessment.

Groundwater contamination would eventually be reduced to drinking water standards via monitored natural attenuation.

2.9.3.3.2 Overall Protection of Human Health and the Environment

The one-foot thick stone cover and the geo-synthetic cover in the northwest corner of the CRS Site would be protective of human health and the environment by eliminating exposure to the contaminated soil and by reducing precipitation infiltration, and slowing subsequent leaching of COCs through the soil and into the groundwater in the northwest corner of the CRS Site.

2.9.3.3.3 Compliance with ARARs

2.9.3.3.3.1 Chemical Specific ARARs

The chemical specific ARARs for this proposed alternative are identical to those identified in Section 2.9.3.2.3.1.

2.9.3.3.3.2 Location Specific ARARs

The location specific ARARs for this proposed alternative are identical to those identified in Section 2.9.3.2.3.2.

2.9.3.3.3.3 Action Specific ARARs

The action specific ARARs for this proposed alternative are identical to those identified in Section 2.9.3.2.3.3.

2.9.3.3.3.4 Other Criteria or Guidelines to be considered (TBC)

The TBC for this proposed alternative are identical to those in Section 2.9.3.2.3.4.

2.9.3.3.4 Long-Term Effectiveness and Permanence

For this alternative to remain effective, the cover must be maintained. Maintenance of the stone cover to ensure protection against loss of cover thickness or animal burrows would be required. Maintenance of the geo-synthetic cover to ensure the drainage layer is functioning, and the top cover soil is not eroding or animals burrowing down to the geo-synthetic layer would be required. Because this alternative would leave hazardous substances on-site, a EPA review would be conducted every five years to ensure the remedy continues to provide adequate protection of human health and the environment in accordance with CERCLA §121(c).

2.9.3.3.5 Reduction of Toxicity, Mobility, and Volume through Treatment

This alternative would provide minimal reduction in the toxicity or volume of the contaminated material. The contaminated soil would remain on-site and be covered by a soil cover and a geo-synthetic cover. The geo-synthetic cover would reduce mobility of the COCs in the soil. Natural degradation would reduce the toxicity and volume of the contaminants in the groundwater via natural attenuation.

2.9.3.3.6 Short-Term Effectiveness

Dust production during the short term may be temporarily increased due to demolition activities and re-grading for cover construction. Dust generation would be minimized through engineering controls to be implemented by the Contractor and as specified in the construction documents. Environmental impacts would be immediately eliminated upon construction of the stone and geo-synthetic covers.

2.9.3.3.7 Implementability

The stone and geo-textile covers would be easy to construct. An estimated 8,600 square yards of stone and geo-textile would need to be brought on-site and placed across the CRS Site to create the stone cover. The geo-textile would prevent plants from growing through it and would act as a barrier to animals trying to burrow through the stone. The geo-synthetic cover materials (geo-membrane and geo-grid drainage layer) are readily available from several suppliers. The soil over the geo-membrane cover would be seeded and would be periodically maintained. Monitoring for signs of failure or need of repair may be readily accomplished. Additional future actions are not prohibited from being implemented by this action.

2.9.3.3.8 Cost

The capital cost for construction of this Alternative is estimated to be $761,000. The 30- year present net worth including an annual O&M 0 is $1,430,000.

2.9.3.4 Alternative 4 – Asphalt Cover

Estimated Capital Cost: $791,000
Estimated Total Present-Worth Cost: $1.4Million + cost of new wells $179,388=$1.53Million
Estimated Annual O&M Cost: $70,000 1st 4yrs, then $50,000 Annually
Estimated Construction Timeframe: 4 months
Estimated Time to Achieve Remedial Action Objectives >30 years

2.9.3.4.1 Description of Alternative

This alternative consists of an asphalt cover that covers the two-acre portion of the CRS Site. The asphalt cover would consist of a type 304 stone six inches thick base and four inches of asphalt. The other 0.5 acres of the CRS Site would have a geo-synthetic cover to address the need for an infiltration barrier cover. The asphalt cover could also be placed over this 0.5 acre area requiring an infiltration cover if preferred, as it also is suitable as an infiltration barrier cover. The two existing buildings would be demolished, the concrete and crushed bricks used on-site as backfill, only if sampling analysis show that the materials are clean. Metal, glass, and

asbestos containing debris will be disposed of off-site. The wood chips and other vegetation debris in the former aboveground storage tank area would be disposed of off-site. The slope to the River would be regraded and have erosion protection (riprap) installed. Penetrations to the storm sewer, which is the property of the City of Elyria, would be sealed off. Repair of the storm sewer would be coordinated with the City of Elyria. The 12-inch outfall at the south side of the CRS Site will be plugged. A fence would be placed around the entire CRS Site perimeter (top of slope at River). A deed restriction would be placed on the CRS Site to limit the future use of the CRS Site to commercial/industrial type applications that meet the assumptions in the baseline risk assessment.

Groundwater contamination would eventually be reduced to drinking water standards via monitored natural attenuation.

2.9.3.4.2 Overall Protection of Human Health and the Environment

The asphalt cover and the geo-synthetic cover in the northwest corner of the CRS Site would be protective of human health and the environment by eliminating exposure to the contaminated soil and by reducing precipitation, infiltration, and slowing subsequent leaching of COCs through the soil and into the groundwater in the northwest corner of the CRS Site.

2.9.3.4.3 Compliance with ARARs

2.9.3.4.3.1 Chemical Specific ARARs

The chemical specific ARARs for this proposed alternative are identical to those identified in Section 2.9.3.2.3.1

2.9.3.4.3.2 Location Specific ARARs

The location specific ARARs for this proposed alternative are identical to those identified in Section 2.9.3.2.3.2.

2.9.3.4.3.3 Action Specific ARARs

The action specific ARARs for this proposed alternative are identical to those identified in Section 2.9.3.2.3.3, with the exception of the addition of the following:

The Ohio Environmental Protection Agency (OEPA) Division of Emergency and Remedial Response has issued “Asphalt Covers to Prevent Leaching at Industrial Sites” and “Use of Asphalt Covers over Contaminated Soil” (DERR-00-TDCE-001 and -004) to be considered when using an asphalt cover as a corrective action measure.

2.9.3.4.3.4 Other Criteria or Guidelines to be considered (TBC)

The TBC for this proposed alternative are identical to those in Section 2.9.3.2.3.4.

2.9.3.4.4 Long-Term Effectiveness and Permanence

For this alternative to remain effective, the cover must be maintained. Maintenance of the asphalt cover would be required as cracks develop. Maintenance of the geo-synthetic cover to ensure the drainage layer is functioning, and the top cover soil is not eroding or animals burrowing down to the geo-synthetic would be required. Because this alternative would leave hazardous substances on-site, an EPA review would be conducted every five years to ensure the remedy continues to provide adequate protection of human health and the environment in accordance with CERCLA §121(c).

2.9.3.4.5 Reduction of Toxicity, Mobility, and Volume through Treatment

This alternative would provide minimal reduction in the toxicity or volume of the contaminated material. The contaminated soil would remain on-site and be covered by an asphalt cover and a geo-synthetic cover. The asphalt cover and the geo-synthetic cover would reduce mobility of the COCs in the soil. Natural attenuation would reduce the toxicity and volume of the contaminants in the groundwater.

2.9.3.4.6 Short-Term Effectiveness

Dust production during the short term may be temporarily increased due to demolition activities and re-grading for cover construction. Dust generation would be minimized through engineering controls to be implemented by the Contractor and as specified in the construction documents. Environmental impacts would be immediately eliminated upon construction of the asphalt and geo-synthetic covers.

2.9.3.4.7 Implementability

The asphalt and geo-synthetic covers would be easy to construct. An estimated 8,600 square yards of stone (6" thick) and asphalt (4" thick) would need to be brought on-site and placed across the CRS Site to create the asphalt cover. The geo-synthetic cover materials (geo-membrane and geo-grid drainage layer) are readily available from several suppliers. The soil over the geo-membrane cover would be seeded and would be periodically maintained. An asphalt cover does not self-heal and would require inspection and repair of cracks. The asphalt cover is ideal however, as a parking lot or storage area. Monitoring for signs of failure or need of repair may be readily accomplished. Additional future actions are not prohibited from being implemented by this action.

2.9.3.4.8 Cost

The capital cost for construction of this Alternative is estimated to be $791,000. The 30-year present net worth including an annual O&M is $1,530,000.

2.9.3.5 Alternative 5 – Concrete Cover

Estimated Capital Cost: $837,000
Estimated Total Present-Worth Cost: $1.4 Million cost of new wells $179,388=$1.58Million
Estimated Construction Timeframe: 4 months

Estimated Annual O&M Cost: $70,000 1st 4yrs, then $50,000 Annually
Estimated Time to Achieve Remedial Action Objectives >30 years

2.9.3.5.1 Description of Alternative

This alternative consists of a concrete cover that covers the two-acre portion of the CRS Site, which can have a contact cover. The concrete cover would consist of a type 304 stone six inches thick base and four inches of concrete. The other 0.5 acres of the CRS Site would have a geo-synthetic cover to address the need for an infiltration barrier cover. The concrete cover could also be placed over this 0.5 acre area requiring an infiltration cover if preferred, as it also is suitable as an infiltration barrier cover. The two existing buildings would be demolished, the concrete and crushed bricks used on-site as backfill, only if sampling analysis show that the materials are clean. Metal, glass, and asbestos containing debris will be disposed of off-site. The wood chips and other vegetation debris in the former aboveground storage tank area would be disposed of off-site. The slope to the River would be regraded and have erosion protection (riprap) installed. Penetrations to the storm sewer, which is the property of the City of Elyria, would be sealed off. Repair of the storm sewer would be coordinated with the City of Elyria.

The 12-inch outfall at the south side of the CRS Site will be plugged. A fence would be placed around the entire CRS Site perimeter (top of slope at River). A deed restriction would be placed on the CRS Site to limit the future use of the CRS Site to commercial/industrial type applications that meet the assumptions in the baseline risk assessment.

Groundwater contamination would eventually be reduced to drinking water standards via monitored natural attenuation.

2.9.3.5.2 Overall Protection of Human Health and the Environment

The concrete cover and the geo-synthetic cover in the northwest corner of the CRS Site would be protective of human health by eliminating exposure to the contaminated soil and by reducing precipitation, infiltration, and slowing subsequent leaching of COCs through the soil and into the groundwater in the northwest corner of the CRS Site.

2.9.3.5.3 Compliance with ARARs

2.9.3.5.3.1 Chemical Specific ARARs

The chemical specific ARARs for this proposed alternative are identical to those identified in Section 2.9.3.2.3.1.

2.9.3.5.3.2 Location Specific ARARs

The location specific ARARs for this proposed alternative are identical to those identified in Section 2.9.3.2.3.2.

2.9.3.5.3.3 Action Specific ARARs

The action specific ARARs for this proposed alternative are identical to those identified in Section 2.9.3.2.3.3.

2.9.3.5.3.4 Other Criteria or Guidelines to be considered (TBC)

The TBC for this proposed alternative are identical to those in Section 2.9.3.2.3.4.

2.9.3.5.4 Long-Term Effectiveness and Permanence

For this alternative to remain effective, the cover must be maintained. Maintenance of the geo-synthetic cover to ensure the drainage layer is functioning, and the top cover soil is not eroding or animals burrowing down to the geo-synthetic would be required. Because this alternative would leave hazardous substances on-site, a EPA review would be conducted every five years to ensure the remedy continues to provide adequate protection of human health and the environment in accordance with CERCLA §121(c).

2.9.3.5.5 Reduction of Toxicity, Mobility, and Volume through Treatment

This alternative would provide minimal reduction in the toxicity or volume of the contaminated material. The contaminated soil would remain on-site and be covered by a concrete cover and a geo-synthetic cover. The concrete cover and the geo-synthetic cover would reduce mobility of the COCs in the soil. Natural attenuation would reduce the toxicity and volume of the contaminants in the groundwater.

2.9.3.5.6 Short-Term Effectiveness

Dust production during the short term may be temporarily increased due to demolition activities and re-grading for cover construction. Dust generation would be minimized through engineering controls to be implemented by the Contractor and as specified in the construction documents. Environmental impacts would be immediately eliminated upon construction of the concrete and geo-synthetic covers.

2.9.3.5.7 Implementability

The concrete cover would be easy to construct. An estimated 8,600 square yards of stone (6" thick) and concrete (4" thick) would need to be brought on-site and placed across the CRS Site to create the concrete cover. The geo-synthetic cover materials (geo-membrane and geo-grid drainage layer) are readily available from several suppliers. The soil over the geo-membrane cover would be seeded and would be periodically maintained. The concrete cover does not self-heal would require inspection and repair of cracks. Monitoring for signs of failure or need of repair would be readily accomplished. Additional future actions are not prohibited from being implemented by this action.

2.9.3.5.8 Cost

The capital cost for construction of this Alternative is estimated to be $837,000. The 30-year present net worth including an annual O&M cost of 70, 000 for the 1st four years, then $50,000 for the next 26 years is $1.58 million.

2.9.3.6 Alternative 6 – Excavation/Disposal and Soil Cover, the Selected Remedy

Estimated Capital Cost: $1.9 Million + cost of new wells $179,388=$2.1 Million. \
Estimated Annual O&M Cost: $70,000 1st 4yrs, then $50,000 Annually
Estimated Total Present-Worth Cost: $2,056,762 Estimated Construction Timeframe: 6 months
Estimated Time to Achieve Remedial Action Objectives < 30 years

2.9.3.6.1 Description of Alternative

The contaminated soil located in the NW corner of the CRS Site would be excavated to a depth of 4-feet (3,500 yd^3) and disposed of off-site to an appropriate disposal facility, (solid waste or a hazardous waste, depending on soil analyses). Based on the RI sampling data for this area, the top 4-feet is where 50% of the contaminant mass of the 0.5-acre is located. The lateral extent of the excavation will be determined in the pre-design phase of the project; however, it is likely to coincide with the same surface area of the geo-membrane cover shown in Figure 6. After excavation, confirmatory surficial (0-6 inches) soil samples would be collected to document the contaminant levels left in place. No additional soil removal would be required. The addition of a two feet soil cover would be added over the entire CRS Site.

The two existing buildings would be demolished, the concrete and crushed bricks used on-site as backfill, only if sampling analysis show that the materials are clean. Metal, glass, and asbestos containing debris will be disposed of off-site. The wood chips and other vegetation debris in the former aboveground storage tank area would be disposed of off-site. The slope to the River would be regraded and have erosion protection (riprap) installed. Penetrations to the storm sewer, which is the property of the City of Elyria, would be sealed off. Repair of the storm sewer would be coordinated with the City of Elyria.

The 12-inch outfall at the south side of the CRS Site will be plugged. A fence would be placed around the entire CRS Site perimeter (top of slope at River). A deed restriction would be placed on the CRS Site to limit the future use of the CRS Site to commercial/industrial type applications that meet the assumptions in the baseline risk assessment.

Groundwater contamination would eventually be reduced to drinking water standards via monitored natural attenuation.

2.9.3.6.2 Overall Protection of Human Health and the Environment

This alternative is protective of human health and the environment by eliminating exposure to the contaminated soil via excavation of the most highly contaminated soil with off-site disposal. In the short-term, there is a temporary exposure risk during the soil excavation of the highly contaminated soil, and during shipment to the appropriate disposal facility.

2.9.3.6.3 Compliance with ARARs

The Selected Remedy will comply with all identified applicable or relevant and appropriate federal requirements and with those State or local requirements that are more stringent, unless a waiver is invoked pursuant to Section 121(d)(4)(B) of CERCLA. The ARARs for the selected remedy are listed in Section 2.15, Table 11, and below:

2.9.3.6.3.1 Chemical Specific ARARs

The chemical specific ARARs for this selected alternative are identical to those identified in Section 2.9.3.2.3.1, except for the following:

Chemical Specific ARARs for Soils:

Standard, Requirement, Criteria or Limitation	Regulatory Citation	Description
Resource Conservation and Recovery Act (RCRA)	40 CFR 261 Subparts C & D	RCRA classification of hazardous wastes
Ohio Hazardous Waste Management Regulations	OAC 3745-50 to 69	State equivalent of RCRA hazardous waste regulations
RCRA Land Disposal Restrictions (LDRs)	40 CFR 268	Concentrations above which land disposal is prohibited
Toxic Substances Control Act (TSCA)	40 CFR Part 761	Regulates the handling and off-site disposal of PCBs that exceeds 50ppm
Clean Air Act (CAA)	42 U.S.C. 7401(et seq.)	Regulations to protect ambient air quality
Clean Water Act (CWA)	33 USC 1251	Regulations to protect the quality of surface waters

Chemical Specific ARARs for groundwater:

Safe Drinking Water Act, MCLs are relevant and appropriate regulation for the groundwater contamination. The groundwater is expected to be restored to MCLs for COCs in a reasonable timeframe under the monitored natural attenuation groundwater remedial action.

2.9.3.6.3.2 Location Specific ARARs

The location specific ARARs for this selected alternative are identical to those identified in Section 2.9.3.2.3.2.

2.9.3.6.3.3 Action Specific ARARs

The action specific ARARs for this selected alternative are identical to those identified in Section 2.9.3.2.3.3, except for the addition of the following:

Action Specific ARARs for Soils:

Standard, Requirement, Criteria or Limitation	Regulatory Citation	Description
RCRA	40 CFR 262-268	Requirements for managing RCRA hazardous wastes.
Ohio Hazardous Waste Management Regulations	OAC 3745-50 to 69	State equivalent of RCRA hazardous waste regulations.
Hazardous Materials Transportation Act DOT	49 USC § 1801	Regulates how contaminated materials may need to be handled, placarded and transported.
Toxic Substances Control Act (TSCA)	40 CFR Part 761	Regulates the handling and off-site disposal of PCBs that exceeds 50ppm.
Clean Air Act (CAA)	42 USC 7401 et seq.	Regulations to protect ambient air quality.
Clean Water Act (CWA) formerly known as the Water Pollution Control Act	33 USC 1251	Regulations to protect the quality of surface water.
Ohio Surface Water Quality Criteria	OAC 3745-01	Represent the States equivalent to the Clean Water Act

2.9.3.6.3.4 Other Criteria or Guidelines to be considered (TBC)

The TBC for this proposed alternative are identical to those in Section 2.9.3.2.3.4.

2.9.3.6.4 Long-Term Effectiveness and Permanence

This alternative is effective in the long-term as the direct contact threat from the CRS Site contaminants would be eliminated by removal and off-site disposal of the most highly contaminated soil and covering of all remaining soil contamination. By removing 50% of the contaminant mass in the most highly contaminated area of the CRS Site, contaminant availability to future groundwater contamination is greatly reduced. Off-site disposal of the most highly contaminated soil effectively address the principal threat source material, which is otherwise likely to migrate and further contaminate groundwater and the River.

2.9.3.6.5 Reduction of Toxicity, Mobility, and Volume through Treatment

This alternative would provide minimal reduction in the toxicity, mobility, or volume of the contaminated material. The highly contaminated soil would be removed and disposed of off-site, but not treated to reduce its toxicity, mobility and volume. Treatment alternatives for this

highly contaminated soil were evaluated, however, found to not be feasible. Residual soil contamination remaining on-site would also not be treated; however the soil cover would reduce mobility of the remaining soil contaminants. Natural attenuation would reduce the toxicity and volume of the contaminants in the groundwater.

2.9.3.6.6 Short-Term Effectiveness

Dust production during the short term of the construction activities may be temporarily increased due to demolition activities and excavation of the contaminated soils. Dust generation would be minimized through engineering controls required during the implementation. The on-site environmental impacts would be immediately eliminated upon removal of the contaminated soils. An estimated 360 vehicles (trips) would be required for hauling contaminated soil through downtown Elyria and also for bringing clean fill into the CRS Site. Transportation-related risks would increase in the short term.

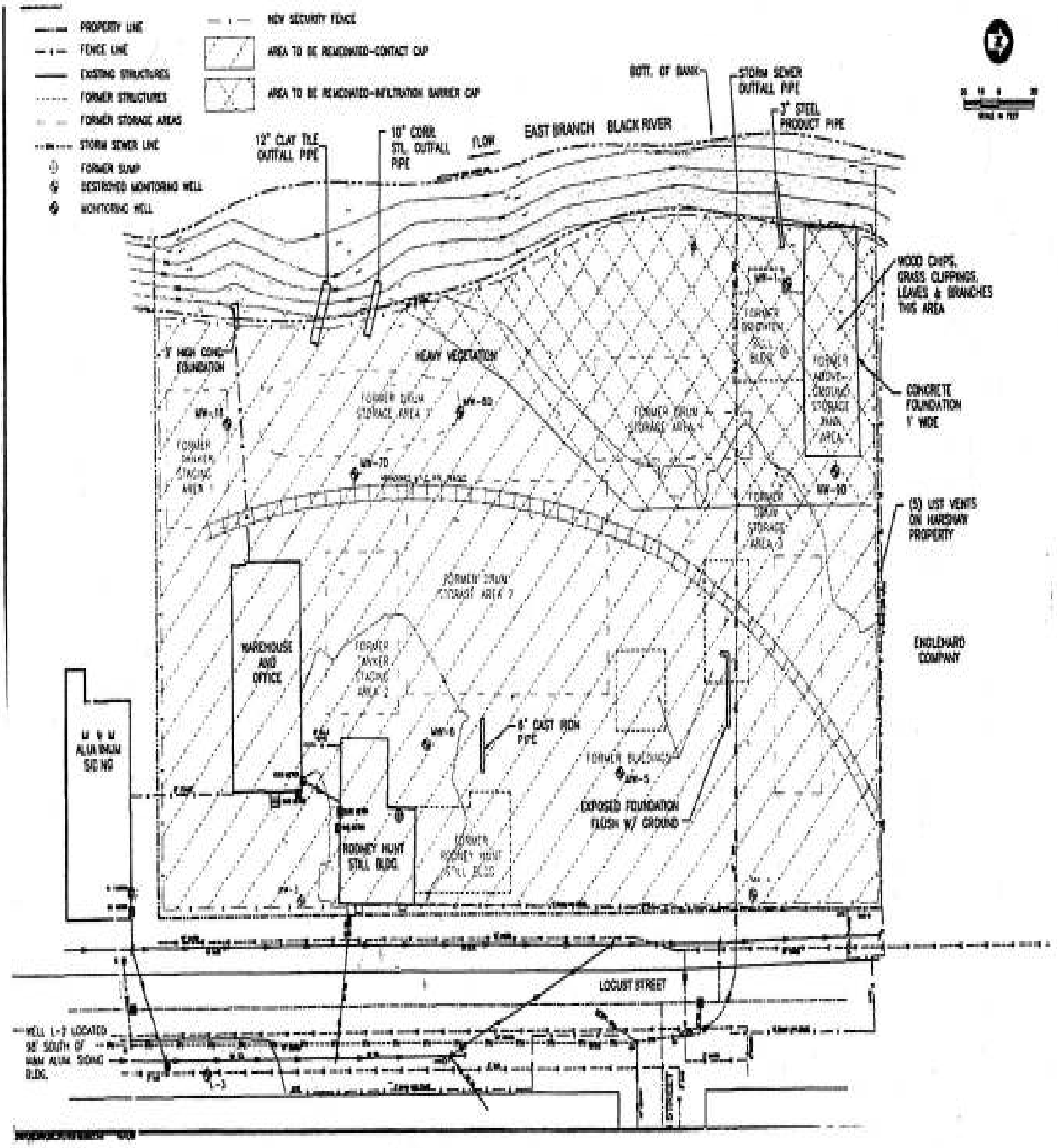
2.9.3.6.7 Implementability

The construction is estimated to take six months and a significant number of vehicles would be hauling contaminated soil out of the CRS Site and bringing clean fill into the CRS Site. The equipment required to perform the work is readily available.

2.9.3.6.8 Cost

This cost is based on an assumption that 25% of the excavated soil would be classified as hazardous waste and 75% would be classified as non-hazardous and would be disposed in facilities accordingly to these classifications. The capital cost for construction of this Alternative is estimated to be $1,334,123. The 30-year present net worth including an annual O&M is $2,056,762.

Figure 6 Alternatives 2- 6
Various Cover Systems over (2.0-Acres) Infiltration Barrier or Excavation of NW corner (0.5-Acres) for the CRS Site



2.9.3.7 Alternative 7 Total CRS Site Excavation

Estimated Capital Cost: $8,100,000/25,200,000#*
Estimated Annual O&M Cost: $70,000 1st 4yrs, then $50,000 Annually
Estimated Total Present-Worth Cost: $7,980,000/24,000,000 Estimated Construction Timeframe: 6 months
Estimated Time to Achieve Remedial Action Objectives 30 years
**Assumes 25% Hazardous Waste Disposal Costs, #Assumes 100% Hazardous Waste Disposal Cost*

2.9.3.7.1 Description of Alternatives

With this Alternative, all soil contaminated above health-based limits (approximately 14,400 cubic yards) would be excavated and disposed of off-site at a non-hazardous or a hazardous disposal location (depending on soil analyses), backfilled with clean fill with the top two feet being clean soil, graded and seeded.

The two existing buildings would be demolished, the concrete and brick crushed and used as backfill, as appropriate. Metal, glass, and asbestos containing debris would be disposed of off-site. The wood chips and other vegetation debris in the former aboveground storage tank area would be disposed of off-site. The slope to the River would be regraded and have erosion protection (riprap) installed. Penetrations to the storm sewer, which is the property of the City of Elyria, would be sealed off. Repair of the storm sewer would be coordinated with the City of Elyria. Fence the entire CRS Site perimeter (top of slope at River). Institutional controls such as a restrictive covenant or other appropriate controls to limit the future use of the CRS Site to commercial/industrial type zoning that meet the assumptions in the baseline risk assessment.

Groundwater contamination would be reduced to drinking water standards via monitored natural attenuation.

2.9.3.7.2 Overall Protection of Human Health and the Environment

This alternative is protective of human health and the environment by eliminating exposure to the contaminated soil (removing it from the CRS Site). In the short term, there is a temporary exposure risk during the soil excavation of the contaminated soil and during shipment to the disposal facility.

2.9.3.7.3 Compliance with ARARs

2.9.3.7.3.1 Chemical Specific ARARs

The chemical specific ARARs for this alternative are identical to those identified in Section 2.9.3.2.3.1 and 2.9.3.2.6.1.

2.9.3.7.3.2 Location Specific ARARs

The location specific ARARs for this proposed alternative are identical to those identified in Section 2.9.3.2.3.2.

2.9.3.7.3.3 Action Specific ARARs

The action specific ARARs for this proposed alternative are identical to those identified in Section 2.9.3.2.3.3, and 2.9.3.6.3.5, (Alternative 6).

2.9.3.7.3.4 Other Criteria or Guidelines to be considered (TBC)

The TBC for this proposed alternative are identical to those in Section 2.9.3.2.3.4.

2.9.3.7.4 Long-Term Effectiveness and Permanence

This alternative is effective in the long-term. The direct contact threat from site contaminants would be eliminated by removal and off-site disposal of all soil above the action limit. Off-site disposal of the contaminated soil effectively addresses the principal threat source materials likely to migrate to further contaminate groundwater and the River.

2.9.3.7.5 Reduction of Toxicity, Mobility, and Volume

This alternative would provide minimal reduction in the toxicity, mobility, or volume of the contaminated material. The contaminated soil would be removed and disposed of off-site, but not treated to reduce its toxicity, mobility, and volume. Treatment alternatives for the highly contaminated soil were evaluated, however, found to not be feasible. Natural attenuation would reduce the toxicity and volume of the contaminants in groundwater.

2.9.3.7.6 Short-Term Effectiveness

Dust production during the short term of the construction activities may be temporarily increased due to demolition activities and excavation of the contaminated soils. Dust generation would be minimized through engineering controls required during the implementation. The on-site environmental impacts would be immediately eliminated upon removal of the contaminated soils. An estimated 1,800 vehicles (trips) would be required for hauling contaminated soil through downtown Elyria and also for bringing clean fill into the CRS Site. Transportation-related risks would increase in the short term.

2.9.3.7.7 Implementability

The construction is estimated to take six months and a significant number of vehicles would be hauling contaminated soil out of the CRS Site and bringing clean fill into the CRS Site. The equipment required to perform the work is readily available. Excavation of soil at significant depths may require soil dewatering, as the groundwater table may be encountered.

2.9.3.7.8 Cost

This cost is based on an assumption that 25% of the excavated soil would be classified as hazardous waste and 75% would be classified as non-hazardous and would be disposed in facilities accordingly to these classifications. The capital cost for construction of this Alternative is estimated

to be $8,100,000. The 30-year present net worth including an annual O&M is $8,100,000. The capital cost based on an assumption that 100% of the excavated soil would be classified as hazardous; the 30-year present net worth cost would be approximately $25.2 million.

2.9.4 Expected Outcomes of Each Alternative

The "No Action" alternatives would not address the unacceptable risk to human health and the environment at the CRS Site. It would not allow the land to be used without restrictions. Contamination migration would be expected to continue.

2.9.4.1 Alternatives 2 – 5: Soil, Stone, Asphalt, and Concrete Covers & Infiltration Barrier

These alternatives would address the unacceptable risk posed by the direct contact threat to the contaminated soils by covering the contaminated soil. These alternatives would reduce, but not eliminate the highly contaminated soil in the NW corner, (0.5-acres) of the site serving as a source for continued and additional groundwater contamination. The groundwater contamination would be addressed by monitored natural attenuation; however, MCLs may not be reached within a reasonable time frame with the highly contaminated soil remaining on-site.

2.9.4.2 Alternative 6 – Excavation (0.5 – acres, NW corner) & Soil Cover

This alternative addresses the unacceptable risk posed by the direct contact threat to the contaminated soil with a combination of excavation with off-site disposal of the highly contaminated soil located in the NW corner (0.5-acres), and covering the remaining contaminated soil (2.0-acres) with two-feet of clean soil. Off-site disposal of the most highly contaminated soil would eliminate the risk of these soils, which serves as a source of continued and additional groundwater contamination. The groundwater contamination would be addressed by monitored natural attenuation.

2.9.4.3 Alternative 7 – Excavation (2.5-acres) Off-site Disposal

This alternative would address the unacceptable risk posed by the direct contact threat to the contaminated soils with off-site disposal of all excavated soils contaminated above health-based limits. Off-site disposal of the soil would also eliminate the risk of the soils serving as a source of continued and additional groundwater contamination. The groundwater contamination would be addressed by monitored natural attenuation.

2.10 Comparative Analysis of Alternatives

In the following analysis, the alternatives were evaluated in relation to one another for each of the evaluation criteria. The purpose of this analysis is to identify the relative advantages and disadvantages of each alternative. Table 8 provides a summary of the remedial alternatives evaluated.

2.10.1 Overall Protection of Human Health and the Environment

All of the alternatives, except Alternative 1 (No Action), provide adequate protection of human health and the environment by eliminating the direct contact threat to contaminated soil and using monitored natural attenuation to reach the MCLs for groundwater COCs. Alternative 6 and 7 provide greater assurance that the groundwater cleanup goals will be reached in a reasonable timeframe, by removing from the site the highly contaminated soil source of additional and continued groundwater contamination. By removing the most highly contaminated or all soil from the site, Alternative 6 and 7 also provide greater level of protection against direct contact with contaminated soils that the other alternatives.

2.10.2 Compliance with Applicable or Relevant and Appropriate Requirements

The evaluation of the ability of the alternatives to comply with ARARs included a review of chemical-specific, location-specific, and action-specific ARARs. All of the alternatives, except Alternative 1 (No Action), would meet all of their respective ARARs.

2.10.3 Long-Term Effectiveness and Permanence

Alternative 7 provides the greatest degree of long-term effectiveness and permanence, with minimal maintenance activities required once groundwater cleanup goals are met. Alternative 6 provides a very high degree of long-term effectiveness and permanence for the on-site remedy because the highly contaminated soils are excavated and disposed of off-site, leaving only low level soil contamination on-site for long-term maintenance. All of the remaining containment alternatives provide long-term effectiveness and permanence with properly performed Operation and Maintenance activities throughout time. Of the containment alternatives, Alternatives 4 and 5 would require more maintenance than Alternatives 2 and 3. Alternative 1, the No Action Alternative, does not provide for long-term effectiveness or permanence.

2.10.4 Reduction of Toxicity, Mobility, or Volume through Treatment

None of the Alternatives use any treatment technologies to reduce toxicity, mobility, or volume of the contaminants in soil. Alternatives 2-7 use monitored natural attenuation to reduce the toxicity and mobility of the contaminants in groundwater.

2.10.5 Short-Term Effectiveness

All of the alternatives can be implemented in a reasonable amount of time, although Alternatives 2 through 5 may take a long time to reach the MCLs for groundwater because highly contaminated soil is left in place that may serve as a source of continued and additional groundwater contamination. Alternative 1 also does not provide for groundwater monitoring to verify that monitored natural attenuation of groundwater contaminants is taking place. All alternatives can be implemented without presenting a risk to the community or on-site workers during construction. Alternatives 2-7 would require on-site air monitoring and dust control during remedy implementation. Alternatives 6 and 7 would take longer to implement than the other alternatives, and would have temporary short-term impacts during the construction and transportation activities, while the contaminated soil is excavated for disposal off-site.

2.10.6 Implementability

Alternatives 2 through 7 are technically feasible to implement. These alternatives use technologies that are easily constructed with readily available materials. These alternatives use technologies that are reliable; although Alternatives 6 and 7 provide greater reliability that the monitored natural attenuation groundwater remedy will be successful in a reasonable amount of time because the highly contaminated soils and all the contaminated soils respectively are removed from the site.

Depending on the use, the vegetation on the soil cover in Alternative 2 would have to be mowed or tended periodically during the growing season. The stone cover, Alternative 3, would only require maintenance if the thickness of the stone was disturbed (by unusual movement of a piece of equipment, etc.) or the filter fabric was damaged. Alternatives 4 and 5 would require repairs of cracks that may develop in the asphalt (Alternative 4), or the concrete (Alternative 5) cover. The geosynthetic liners in Alternatives 2 through 5 require little maintenance except checking to ensure that the drainage outlet from the drainage layer is open and draining. The vegetated top surface would need to be maintained as discussed for the soil cover alternative.

Alternative 6 would require the movement of approximately 360 truckloads trips over six months time to transport the contaminated soil off-site to the disposal location(s) and also to bring clean fill on-site as backfill. The movement of vehicles may be temporarily disruptive to the community, as they must pass through downtown Elyria. There is an additional access to the CRS Site via Pine Street, which would require coordination with BASF to unlock the fence and allow the trucks to use Pine Street, to eliminate some of the downtown truck traffic.

Alternative 7 would require the movement of over 1,800 truckload trips over six months time to transport the contaminated soil off-site to the disposal location and also to bring clean fill on-site as backfill. The movement of this large quantity of vehicles may be temporarily disruptive to the community, as they must pass through downtown Elyria. There is an additional access to the CRS Site via Pine Street, which would require coordination with BASF to unlock the fence and allow the trucks to use Pine Street, to eliminate some of the downtown truck traffic. The excavation depth may be up to approximately 18 feet. Sheeting and shoring of the excavations may be needed if excavation is required at significant depths. It may also be necessary to handle groundwater in contact with contaminated soil.

2.10.7 Cost

The No Action Alternative is the least costly alternative with no associated costs. Using the estimated total present worth cost as the basis for comparison, Alternatives 2-5 are very similar in cost ranging from the least costly Alternative 3 ($1.43M) to the most costly Alternative 5 (1.58 M). Alternative 6 is the next most costly alternative ($2.1M) at slightly more than 1.25 times the cost of Alternative 5. Alternative7 is the most costly alternative ($8.1M), several time the cost of the containment alternatives, and over three time the cost of Alternative 6.

2.10.8 State/Support Agency Acceptance

The Ohio EPA agrees with the EPA's selection of Alternative 6 as the Selected Remedy for the CRS Site.

2.10.9 Community Acceptance

EPA conducted a public meeting on July 26, 2007 to present the Proposed Plan to the public and presented Alternative 6 as the preferred alternative for the impacted media at the CRS Site.

The community did not present any opposition to any of the alternatives presented, including the Selected Remedy during the meeting or during the 30-day comment period. Based on the comments received the community accepts all of the alternatives including the Selected Remedy presented in this ROD.

Table 8 Summary of Alternatives Compared to the Nine Evaluation Criteria

Evaluation Criteria	Alternatives						
	Additional Cost Added to all Alternatives for Pre-design Monitoring Well Placement						
	1	2	3	4	5	6	7
1. Overall Protection of Human Health & the Environment	☐	▭	▭	▭	▭	▭	▭
2. Compliance with ARARs	☐	▭	▭	▭	▭	▭	▭
3. Long-Term Effectiveness and Permanence	☐	■	■	■	■	▭	▭
4. Reduction of Toxicity, Mobility, of Volume Through Treatment	☐	☐	☐	☐	☐	▭	▭
5. Short-Term Effectiveness	☐	■#	■#	■#	■#	■#	■#
6. Implementability	☐	▭	▭	▭	▭	▭	▭
7. Cost – Capital Construction Cost (including 30-yr. operation & maintenance period of a minimum of 30 years; approx. $50,000 annually)	$0	**$1.34 million + $179,388** **Cost with new wells** **$1.52 million**	**$1.25 million + $179,388** **Cost with new wells** **$1.43 million**	**$1.35 million + $179,388** **Cost with new wells** **$1.53 million**	**$1.40 million + $179,388** **Cost with new well** **$1.58 million**	**$2.1 million + $179,388** **Cost with new wells** **$2.1 million**	**$7.98 million/ $24million* + $179,388** **Cost with new wells** **$8.1million/ $25.2 million***
8. State Acceptance	☐	▭	▭	▭	▭	▭	▭
9. Community Acceptance	☐	▭	▭	▭	▭	▭	▭

☐ Does not meet criteria ■ Partially meets criteria ▭ Fully meets criteria

Dust produced during demolition, excavation and re-grading of the CRS Site is temporary with short-term exposure.

* Smaller amount is the cost for disposal at a solid waste facility; larger amount is the cost for disposal at a hazardous waste facility.

2.11 Principal Threat Wastes

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP §300.430(a)(1)(iii)(A)). Identifying principal threat waste combines concepts of both hazard and risk. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile, which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur.

The contaminated surface soils in the NW corner of the CRS Site are considered to be "principal threat wastes" because the chemicals of concern are found at concentrations that pose a significant risk. Under the reasonable anticipated future land use scenario of an indoor industrial user, the excess carcinogenic risk is 2×10^{-2} and the non-carcinogenic Hazard Index (HI) is 357 from exposure to the soil contaminants via indoor soil vapor. In addition, these soils may become a source for additional groundwater contamination and river contamination.

None of the alternatives evaluated for the CRS Site would address these principal threat wastes through treatment. A treatment option, soil vapor extraction (SVE), for these highly contaminated soils, was evaluated, post RI/FS. SVE is the preferred remedy for soil contaminated with VOCs. Given the nature of the soil environment in the NW corner of the CRS Site, where these highly contaminated soils are found, it was determined that SVE would not reliably treat these soils. The selected remedy, Alternative 6, will reliably address the threats from these highly contaminated soils of: (1) direct contact, (2) source of additional and continued groundwater and River contamination, and (3) source of vapors to an indoor environment, via off-site disposal.

2.12 Selected Remedy

2.12.1 Summary of the Rationale for the Selected Remedy

The Selected Remedy is Alternative 6: Excavation and off-site disposal of the top four feet of highly contaminated soil in the 0.5-acre, NW portion of the site with a two feet soil cover over the entire site, and monitored natural attenuation of the contaminated groundwater to drinking water standards.

This remedy is protective of human health and the environment and compiles with all relevant and appropriate environmental regulations (ARARs).

This remedy is cost effective because it provides a balance of:

- Long-term effectiveness and permanence;
- Short-term effectiveness, and
- Cost

The long-term effectiveness is achieved via off-site disposal of the highly contaminated soil, which will address the direct contact threat and eliminate them as a source of continued and additional groundwater contamination and future indoor air vapor. The remedy is protective in the short term. The cost of the remedy is significantly less than two times the cost of the least expensive fully containment alternatives, and many times less expensive than Alternative 7, the full excavation remedy. This remedy is readily implemented and is accepted by the state agency and the public. This remedy does not use treatment to address the principal threat waste at the CRS Site; no effective treatment alternative for the highly contaminated principal threat waste of contaminated soils was identified.

2.12.2 Description of the Selected Remedy

Table 9 provides the Description of the Selected Remedy, Alternative 6; Soil Cover over 2.5-Acres, with Excavation and Off-Site Disposal.

The overall remediation strategy for the CRS Site is to reduce the amount of contamination in soil, sediment, and groundwater to protect both human and ecological receptor from exposure to the following CRS Site-specific chemicals of concern (COCs):

VOCs:

Tetrachloroethene, trichloroethene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, , trans-1,2-dichloroethene, trans-1,3-dichloropropene, 1,2-dichloroethane, 1,1-dichloroethane, cis-1,2-dichloroethene, 1,1-dichloroethene, vinyl chloride, benzene, toluene, ethylbenzene, xylenes, methylene chloride, dibromochloromethane, chloroethane, and chloroform

SVOCs:

Naphthalene, benzo(a)anthracene, benzo(a)pyrene, dibenzo(a,h)anthracene.

benzo(b)fluoranthene, and indeno(1,2,3-c,d)pyrene

PCBs:

Aroclor 1242, Aroclor 1248, Aroclor 1254, and Aroclor 1260

Metals:

Arsenic and manganese

Table 9 Description of Alternative 6, the Selected Remedy

EPA'S SELECTED REMEDY
ALTERNATIVE 6:

Soil Cover over 2.0-acres with Excavation (0.5 acres/NW corner)/Off-Site Disposal Backfill & MNA

1. Excavate the top four feet of highly contaminated soil located in the NW corner (0.5-acres); to address the principal threat source material, (contaminated materials may migrate) to groundwater and future indoor air, which will eliminate the direct contact risk associated with the contaminated soil.
2. Dispose excavated soils off-site per appropriate disposal requirement;
3. Surficial sampling verification (up to 6 inches), to document the level of and type contaminants left in place. No additional soil removal is required;
4. Backfill excavated area with clean fill material, and cover with at least two-feet of clean soil;
5. Application of a marker prior to backfilling, such as orange polyethylene netting, to delineate contaminated soils are underneath;
6. Cover the remainder of the CRS Site (2.0-acres) with two-feet of clean soil, compact and appropriately grade for erosion control;
7. Monitored Natural Attenuation of groundwater to assure groundwater restoration to drinking water standards are achieved for all COCs;
8. Institutional Controls to ensure the CRS Site remains protective of public health and the environment;
9. Perimeter Fencing;
10. Air monitoring and dust suppression during construction;
11. Closure of two on-site sumps pumps;
12. Demolish two on-site structures;
13. Repair sewer line; and
14. 30-year O&M to assure all RAOs continue to be maintained.

The selected remedy removes source materials constituting principal threats at the CRS Site. To eliminate the data gap identified post RI/FS, additional monitoring wells will be placed on-site during the pre-design phase of the project. The purpose is to further identify the lateral groundwater plume and to investigate the potential vapor intrusion pathway threat to residential receptors across the River.

This remedial action is to restore the groundwater to safe drinking water standards by monitored natural attenuation. At the CRS Site the aquifer is not currently being used for potable purposes within a one-mile radius, however once the groundwater is restored, it will be restored to

its beneficial use, and could be used for non-potable purposes. Based on information obtained during the remedial investigation, and the analysis of all remedial alternatives, EPA and Ohio EPA believe that the Selected Remedy may be able to achieve this goal. The lines of evidence to support MNA are presented in Section 2.5.9.4.1. Groundwater contamination is especially persistent in the immediate vicinity of the contaminants' source, where concentrations are relatively high. The ability to achieve the MCLs at all points throughout the area of the plume, cannot be determined until the remedial action has been implemented, and the plume response to the remedial action monitored over time. The CRS Site specific monitoring and sampling plan will be developed consistent with EPA's Monitored Natural Attenuation Guidance (OSWER Directive 9200.4 – 179).

2.12.3 Summary of the Estimated Remedy Cost

The Selected Remedy is expected to cost between $2.1 million dollars. Table 10 shows the detailed cost estimate of Alternative 6, Excavation and Soil Cover with MNA.

Table 10
Detailed Cost Estimate of the Selected Remedy - Alternative 6

COST ESTIMATE FOR THE EXCAVATION AND SOIL COVER REMEDY				
Activity	**Description**	**Quantity**	**EPA Cost**	**Comments**
Transportation and Disposal		3,500 yd3	$341,040.00	Adjusted soil density to 1.5 ton/yd3 soil
Analytical	Final Sampling	20 * $500/sample	$10,000.00	
	Disposal Characterization	10 * $200/sample	$2,000.00	
Subcontractors				
Asbestos Survey[1]		1 LS	$6,000.00	
Asbestos Removal[1]		1 LS	$100,000.00	
Demolition[1]	Warehouse and building	1 LS	$100,000.00	
Crushing of foundations[1]		1 LS	$35,000.00	
Clearing and Grubbing[1]		2.5 acres	$13,750.00	
Fencing[2]		1,300 linear feet	$27,900.00	
Deed restriction[1]		1 LS	$2,000.00	
Sewer replacement[1]		1 LS	$12,000.00	
Re-grade of river slope[1]		1 LS	$2,300.00	
Erosion control matting[3]		2,300 SF	$690.00	
Hydroseeding[3]		109,000 SF	$4,905.00	
Equipment[4,5]	Excavator	1 X 3 months	$9,000.00	2 months rental
	Dozer	1 x 1 month	$3,500.00	Dozer for soil cover
	Loader	1 X 2 months	$3,500.00	1 month rental
	Mob/demobilize	3X $500 X 2	$2,000.00	Mob/Demob 2 equipments
	Office trailer	1 for 3 months	$600.00	
	Multi-Rae	3 month rental	$1,614.00	
	PDR (Dust Monitor)	4 for 2 month rental	$2,728.00	1 month rental
	PDRs	1 for 2 month rental	$1,364.00	
	Fuel	$150 per day	$9,000.00	
Workers[4,5]				
2 operators for 3 weeks	Operators regular	2X40/week X 6 weeks	$12,480.00	3 weeks
	OT	2X20/week X 6 weeks	$7,920.00	3 weeks
1 operator for 6 weeks	Operators regular	1X40/week X 9 weeks	$16,640.00	8 weeks
	OT	1X20/week X 9 weeks	$10,560.00	8 weeks
1 RM	RM	1X60/week X 12 weeks	$42,900.00	11 weeks
1 clerk	Clerk	1X40/week X 12 weeks	$15,840.00	11 weeks
	OT	1X20/week X 12 weeks	$9,900.00	11 weeks
2 technicians for 3 weeks	technician	2X40/week X 6 weeks	$10,080.00	3 weeks
	OT	2X20/week X 6 weeks	$6,360.00	3 weeks
1 technicians for 6 weeks	technician	1X40/week X 9 weeks	$13,440.00	8 weeks
	OT	1X20/week X 9 weeks	$8,480.00	8 weeks

Activity	Description	Quantity	EPA Cost	Comments
1 EPA/contractor	EPA/contractor oversight	1X60/week X 12 weeks	$66,000.00	11 weeks
Travel days	1/day for mob/demob/person	5 hrs one way	$3,440.00	
Backfill	Backfill soil Analytical[6]	1	$2,000.00	
	2-foot clean soil[7]	12,000 yd3	$104,625.00	11,625 yd3
Travel	hotel[8]	7 days X12 weeks/person	$46,200.00	11 weeks (from 9 weeks Projected in our last Estimate) for 6 persons
	per diem[8]	7 days X12 weeks/person	$24,948.00	11 weeks for 6 persons
	vehicle	5 X 70 X7*12	$21,560.00	11 weeks for 4 vehicles
Miscellaneous				
Project Setup, procurement	Field clerk	3 weeks	$675.00	
Staging area construction			$2,000.00	
Utilities	month	3 months	$600.00	
Haul road construction			$300.00	
Demarcation liner installed			$30,000.00	$30,000 for "snow-fence" liner
Well construction	6 wells	$10k per well	$60,000.00	Adjusted for well construction cost
Other misc. items			$5,000.00	
Total			$1,212,839.00	
10% Contingency			$121,283.90	
Grand Total			$1,334,122.90	
Capital Cost			$1,334,122.90	
10% Pre-design and Engineering Design Work			$66,706.15	Estimated 5%for pre-design and design
10% Construction Quality Assurance and Health & Safety Oversight			$26,682.46	Estimated 2% for Construction QA and H&S
Annual O&M cost[1]		100,000 per year		
Present Worth of O&M (projected for 30 years at 8% return)[1]			$629,250.00	Present Worth of O&M with an annual O&M cost of $50,000 for 30 years & an additional annual O&M cost of $20,000 for the first four year
Capital Cost + Present Worth of O&M			$2,056,761.50	

Table 10 cont. Detail Cost Estimate of Selected Remedy - Alternative 6

Assumptions:

a. Transportation and Disposal estimate assumes 0.5 acres excavated to 4 feet. Soil density is assumed to be 1.5 tons per cubic yard.

b. Soil is assumed to be 75% non-hazardous and that 25% will fail TCLP or 10 X LDR requirements

c. Work week = 12 hours / day X 5 days/ week

d. Site work would take 9-12 weeks assuming 7 trucks per day will make trips to the landfill

f. TCLP samples would be collected from excavated soil for disposal analysis

g. 30 site soil samples to be collected for determining VOC concentrations that will remain on site

h. Transportation and disposal cost for non-hazardous soil is based on the quote from Waste Management showing $22.77/ton for disposal, $16/ton for transportation of non-hazardous soil, plus fuel surcharge and $4/truck environmental fee

i. Transportation and disposal cost for hazardous soil is based on the quote from EQ showing $80/ton for disposal, $36/ton for transportation for 10 X LDR soil and $110/ton and $36/ton for hazardous soil. The disposal for 10 X LDR and Hazardous Waste was averaged for $95/ton for disposal

j. Backfill quantity is estimated to cover a 2-foot cap on the 2.5-acre property + 4 feet on 0.5 acres, Gregory Trucking, Inc. gave a quote of $90 per truck, with a truck delivering 11 Cubic yards

k. EPA/contractor oversight cost item is limited to the on-site observation of the construction of the remedy and does not include EPA past costs, EPA oversight costs for the Remedial Design, Remedial Action, and Operation and Maintenance, nor does it include administrative and legal costs associated with the site.

Notes:

1. Costs for asbestos survey, asbestos removal, demolition of buildings, removal of foundations, clearing and grubbing, deed restriction, sewer replacement/plugging, regrade of slope to river, annual O&M cost and rate of return for total present worth calculation were taken from the Parsons Cost Estimate. Additional annual O&M Cost of $20,000 were added for the first four years to reflect additional monitoring requirements that were not in Parsons Cost Estimate. Sampling and analysis costs, which may initially exceed the average annual cost, are expected to decline after two years when the monitoring frequency can move from quarterly to semi-annually and the number of wells sampled may be reduced.

2. Cost for fencing estimation was given by Elyria Fence Inc. for a 8ft chain-link fence at $21/linear foot plus $600 for the gate. Elyria Fence Inc indicated that permanent fencing within the Elyria city limits would require black vinyl coating and would probably triple the costs

3. Great Lakes Hydroseeding Construction gave the cost estimate for erosion control matting plus seeding to be $0.3/ Square foot and hydroseeding with tactifier at $0.045/square foot

4. Work week = 12 hours / day X 5 days/ week

5. Site work is estimated to take 9-12 weeks

6. 1 clean soil sample from the vendor would be would be analyzed prior to backfilling on the site

7. Backfill quantity is estimated to cover a 2-foot cap on the 2.5-acre property + 4 feet of fill in the 0.5 acre excavation area, Gregory Trucking, Inc. gave a quote of $90 per truck, with a truck delivering 11 Cubic yards

8. Federal hotel and per diem rates for this area were used for this cost estimate

2.12.4 Expected Outcome of the Selected Remedy

The reasonably anticipated land is industrial/commercial. The land can be used for this purpose after the Selected Remedy for soil is completed, and all direct contact threats are removed, and the risks are reduced to acceptable levels. It is estimated that the land will be ready for this use approximately 6-months after initiation of construction.

The contaminated groundwater will be restored to its beneficial use, which for the CRS Site would be the achievement of safe drinking water standards. This is currently estimated to take approximately 30-years.

2.13 Statutory Determinations

Under CERCLA §121 and the NCP §300.430(f)(5)(ii), the EPA must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the Selected Remedy meets these statutory requirements.

2.13.1 Protection of Human Health and the Environment

The Selected Remedy for indoor air, soil, and groundwater at the CRS Site will be protective of human health and the environment. Removal of the principal threat wastes in the soil with monitored natural attenuation of current groundwater contamination is expected to restore the groundwater to below drinking water standards.

2.13.2 Compliance with Applicable or Relevant and Appropriate Requirements

The NCP §300.430(f)(5)(ii)(B) and (C) require that a ROD describe the Federal and State ARARs that the Selected Remedy will attain or provide justification for any waivers. ARARs include substantive provisions of any promulgated Federal or more stringent State environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate for a CERCLA site or action. Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Relevant and appropriate requirements are requirements that, while not legally "applicable" to circumstances at a particular CERCLA site, address problems or situations sufficiently similar to those encountered at the CRS Site that their use is relevant and appropriate. The ARARs for Alternative 6 are presented in the above description of Alternative 6. All ARARs for the CRS Site are satisfied in the selected alternative.

2.13.3 Cost Effectiveness

The Selected Remedy is cost effective because the remedy's costs are proportional to its overall effectiveness (see 40 CFR §300.430(f)(l)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., those are protective of human health and the environment and comply with all Federal and any more stringent State ARARs, or as appropriate, waive ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). The overall effectiveness of each alternative was then compared to each alternative's costs to determine cost effectiveness. The relationship of the overall effectiveness of the selected remedial alternative was determined to be proportional to its costs and hence represents a reasonable value for the money to be spent.

2.13.4 Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

EPA has determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the CRS Site. Of those alternatives that are protective of human health and the environment and comply with ARARs, the EPA has determined that the Selected Remedy provides the best balance of tradeoffs in terms of the five balancing criteria:

- long-term effectiveness and permanence;
- reduction of toxicity, mobility or volume through treatment;
- short-term effectiveness;
- implementability; and
- costs

The Selected Remedy removes and provides of off-site disposal of the highly contaminated soil that present a principal threat at the CRS Site. The Selected Remedy satisfies the criteria for long-term effectiveness removing the highly contaminated soil from the CRS Site. The Selected Remedy does not present short-term risks different from the other alternatives. There are no special implementability issues that set the Selected Remedy apart from any of the other alternatives evaluated. No effective treatment alternative for the principal threat waste was identified. All excavated soil will be disposed of per all applicable land disposal restrictions. The cost of the selected remedy is significantly less than two times the cost of the least expensive fully containment alternatives, and many times less expensive than Alternative 7, the full CRS Site excavation remedy.

2.13.5 Preference for Treatment as a Principal Element

EPA has determined that the treatment of the source area wastes via soil vapor extraction system is not effective; therefore, the Selected Remedy does not satisfy the statutory preference for treatment. No effective treatment alternative for the highly contaminated soils could be identified.

2.13.6 Five – Year Review Requirements

CERCLA §121(c) and the NCP §300.430(f)(5)(iii)(C) provide the statutory and legal bases for conducting Five -Year Reviews. Because this remedy is expected to take at least 30 years or more to achieve the RAOs at the CRS Site, and it will result in hazardous substances remaining on-site in the soil at levels that does not allow for unlimited use and unrestricted exposure; a statutory review will be conducted within 5-years after initiation of the remedial action, and every 5-year subsequent, to ensure that the remedy is, or will be, protective of human health and the environment.

2.14 Documentation of Significant Changes from Preferred Alternative of Proposed Plan

EPA has not made any significant changes to the remedy, as originally identified in the Proposed Plan. The Proposed Plan was released for public comment on July 9, 2007. The public comment period for the Proposed Plan was held from July 16, 2007 to September 13, 2007. EPA held a public meeting on July 26, 2007 to present the preferred alternative in the Proposed Plan. EPA reviewed and responded to written and verbal comments submitted during the public comment period in the Responsiveness Summary (Part 3 of this ROD).

2.15 Additional ARARs (Table 11) for the Selected Remedy, Alternative 6, Section 2.9.3.6.3.

Table 11 Additional ARARs for Alternative 6, the Selected Remedy

Ohio Rev. Code 3767.14, 33 U.S.C. 407	Prohibition against throwing refuse, oil, or filth into lakes, streams, or drains.
Ohio Rev. Code 6111.04, 33 U.S.C. 407	Pollution of waters of the state is prohibited.
Ohio Admin. Code 3745-1-04 A,B,C,D,E	All surface waters of the state shall be free from: a) objectionable suspended solids. B) Floating debris, oil and scum. C) Materials that create a nuisance. D) Toxic, harmful or lethal substances. E) nutrients that create nuisance growth
Ohio Admin. Code 3745-1-07 C	Establishes water quality criteria for pollutants which do not have specific numerical or narrative criteria identified in tables 7-1 through 7-15 of this rule.
Ohio Admin. Code 3745-1-27	Establishes water use designations for stream segments within the black river basin.
Ohio Admin. Code 3745-1-33 A-E	Establishes water quality standards for bodies of water draining into lake Erie basin. Used by DSW to establish discharge limits
Ohio Admin. Code 3745-1-33	Establishes chemical criteria for streams in lake Erie drainage basin
Ohio Admin. Code 3745-15-07 A	Defines air pollutant nuisances as the emission or escape into the air from any source(s) of smoke, ashes, dust, dirt, crime, acids, fumes, gases, vapors, odors and combinations of the above that endanger health, safety or welfare of the public or cause personal injury or property damage. Such nuisances are prohibited.
Ohio Admin. Code 3745-17-02 A,B,C	Establishes specific standards for total suspended particulates.
Ohio Admin. Code 3745-17-08 A1, A2,B,D	All emissions of fugitive dust shall be controlled.

Ohio admin. Code 3745-270-40 A-J	Detailed listing of chemical specific land treatment standards or required treatment technologies.
Ohio admin. Code 3745-270-42 A-D	Lists specific treatment technologies required for specific wastes
Ohio admin. Code 3745-270-45 A-D	Specifies treatment technologies and performance standards for various debris.
Ohio admin. Code 3745-270-48 A	Gives contaminant chemical specific standards for land disposal
Ohio admin. Code 3745-270-49 A-E	Specifies standards for soil treatment
Ohio admin. Code 3745-52-11 A-D, 40 C.F.R. 262.11	Any person generating a waste must determine if that waste is a hazardous waste (either through listing or by characteristic).
Ohio admin. Code 3745-52-12 A-C, 40 C.F.R. 262.12	A generator must not store, treat dispose or transport hazardous wastes without a generator number
Ohio admin. Code 3745-52-20, 40 C.F.R. 262.20	Requires a generator who transports or offers for transportation hazardous waste for off-site treatment, storage or disposal to prepare a uniform hazardous waste manifest
Ohio admin. Code 3745-52-22' 40 C.F.R. 262.22	Specifies the number of manifest copies to be prepared
Ohio admin. Code 3745-52-23, 40 C.F.R. 262.23	Specifies procedures for the use of hazardous waste manifests including a requirement that they be hand signed by the generator
Ohio admin. Code 3745-52-30, 40 C.F.R. 262.30	Requires a generator to package hazardous waste in accordance with u.s. dot regulations for transportation off-site.
Ohio admin. Code 3745-52-31, 40 C.F.R. 262.31	Requires packages of hazardous waste to be labeled in accordance with U.S.DOT regulations for off-site transportation.
Ohio admin. Code 3745-52-32, 40 C.F.R. 262.32	Specifies language for marking packages of hazardous waste prior to off-site transportation
Ohio admin. Code 3745-52-33, 40 C.F.R. 262.33	Generator shall placard hazardous waste prior to off-site transportation.
Ohio admin. Code 3745-52-34, 40 C.F.R. 262.34	Identifies maximum time periods that a generator may accumulate a hazardous waste without being considered an operator of a storage facility. Also establishes standards for management of hazardous wastes by generators.
Ohio admin. Code 3745-52-40 A-D, 40 C.F.R. 262.40	Specifies records that shall be kept for three years
Ohio admin. Code 3745-54-13 A, 40 C.F.R. 262.13	Prior to any treatment, storage or disposal of hazardous wastes, a representative sample of the waste must be chemically and physically analyzed.
Ohio admin. Code 3745-54-14 A,B,C, 40 C.F.R. 262.14	Hazardous waste facilities must be secured so that unauthorized and unknowing entry is minimized or prohibited.
Ohio admin. Code 3745-54-34, 40 C.F.R. 264.34	Whenever hazardous waste is being handled, all personnel involved shall have immediate access to an internal alarm or emergency communication device.
Ohio admin. Code 3745-54-37 A,B 40 C.F.R. 264.37	Arrangements or agreements with local authorities, such as police, fire department and emergency response teams must be made. If local authorities will not cooperate, documentation of that non-cooperation should be provided.
Ohio admin. Code 3745-54-52 A-F 40 C.F.R. 264.52	Hazardous waste facilities must have a contingency plan that addresses any unplanned release of hazardous wastes or hazardous constituents into the air, soil or surface water. This rule establishes the minimum required information of such a plan.

Ohio admin. Code 3745-54-53 A,B 40 C.F.R. 264.53	Copies of the contingency plan required by 3745-54-50 must be maintained at the facility and submitted to all local police departments, fire departments, and hospitals local emergency response teams and the Ohio EPA.
Ohio admin. Code 3745-54-54 A, 40 C.F.R. 264.54	The contingency plan must be amended if it fails in an emergency, the facility changes (in its design, construction, maintenance or operation), the list of emergency coordinators change or the list of emergency equipment.
Ohio admin. Code 3745-54-55 40 C.F.R. 264.55	At all times there should be at least one employee either on the premises or on call to coordinate all emergency response measures.
Ohio admin. Code 3745-54-56 A-I, 40 C.F.R. 264.34	Specifies the procedures to be followed in the event of an emergency.
Ohio admin. Code 3745-54-97 A-H, 40 C.F.R. 264.97	Presents general ground water monitoring program requirements. Includes number, location and depth of wells, casing requirements, sampling and analysis procedures, etc.
Ohio admin. Code 3745-54-98 A-I, 40 C.F.R. 264.98	Presents requirements of ground water detection program.
Ohio admin. Code 3745-54-99 A-J, 40 C.F.R. 264.99	Presents requirements of ground water compliance monitoring program.
Ohio admin. Code 3745-55-01 A-F	Presents the requirements of a ground water corrective action program that prevents hazardous constituents from exceeding their respective concentration limits at the compliance point by either removal or treatment of these hazardous constituents.
Ohio admin. Code 3745-55-11 A,B,C	Requires that all hazardous waste facilities be closed in a manner that minimizes the need for further maintenance, controls, minimizes, eliminates or prevents post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off or hazardous waste decomposition products to the ground or surface water or the atmosphere.
Ohio admin. Code 3745-55-14	Requires that all contaminated equipment, structures and soils be properly disposed of or decontaminated. Removal of hazardous wastes or constituents from a unit may constitute generation of hazardous wastes.
Ohio admin. Code 3745-56-51 A-F	Specifies the design and operation requirements for waste piles. Includes liner system, leachate collection and removal system, wind dispersal prevention and run-on/run-off control .
Ohio admin. Code 3745-56-54 A,B	Waste piles must be monitored during construction or installation and operation.
Ohio admin. Code 3745-9-03 A-C	Standards for design and closure of wells, compliance with DDAGW guidance
Ohio admin. Code 3745-9-10 A,B,C	Procedures for closing and sealing wells .

PART 3 RESPONSIVENESS SUMMARY

Comment 1 – The Commenter wanted to know the depths of all the groundwater monitoring wells

EPA's Response: Presently, there are nine monitoring wells on or near the CRS Site. Their depths range from about 21 feet below ground surface to about 55 feet below ground surface. All wells have 10-foot screens, meaning the well that is 21-feet deep actually draws water from 11 to 21 feet deep; the 55-foot deep well draws water from 45 to 55 feet deep, etc. The three deepest wells (MW-7D, MW-8D, and MW-9D) are installed in Bedford Shale bedrock, and the remainder of the wells is installed in unconsolidated materials (mostly fill). Additional wells will be installed during the pre-design studies to better characterize the lateral plume. The actual number of additional wells that will be installed will be determined during the pre-design study.

Comment 2: The Commenter asked what parameters will be examined in the groundwater sampling.

EPA's Response 2: The parameters for groundwater monitoring will be determined as part of a CRS Site-specific monitoring and sampling plan that will be developed consistent with EPA's Monitored Natural Attenuation Guidance (OSWER Directive 9200.4 - 179).

Comment 3: The Commenter asked how far from the site will the sampling be conducted.

EPA's Response 3: All of the monitoring wells are located on the site itself, except for L-3, which is directly across Locust St. from the site, and L-2, which is on Locust St. about 100 feet south of the site's south property line. (L-2 and L-3 were originally installed in association with the BASF Company site across the street from the CRS site). Additional wells may be installed on the other side of the river, depending upon the results of the pre-design studies conducted at the CRS Site.

Comment 4: The Commenter wanted to know what monitoring of the Black River water column and sediments will be done, if any, near this site. If none, why not?

EPA's Response 4: Presently, no monitoring of surface water or sediments is proposed. The determination of the need for additional sampling of the surface water and sediments would be made based on the results of the pre-design studies conducted at the CRS Site. For now, the selected remedy (grading and applying erosion protection to the riverbank, removing and disposing of the most contaminated soils in the northwest corner of the site, and capping the remainder of the site with a 2-foot soil cover) will prevent the migration of contaminated surface soils into the River. It will also prevent precipitation from coming into contact with contaminated soils and infiltrating into groundwater; therefore, there will be no continuing pathways by which contamination will be able to migrate into the River.

Comment 5: The Commenter asked how long monitoring will be conducted after the site is cleaned up.

EPA's Response 5: After the remedy is implemented, groundwater will be monitored until safe drinking water standards are achieved for all chemicals of concern.

Comment 6 – The Commenter asked what methods were used to collect information about the Chemical Recovery Systems site and practices. I understand that interviews of past employees were conducted. May the transcripts be examined? Do I need to file a Freedom of Information Act Request to read them? Where may I find them?

EPA's Response 6: The primary methods used to collect information regarding on-site activities were obtained from the local fire department. Elyria Fire Chief has a file on the CRS Site that documented incidents of spills, fires, explosions, etc. The file includes photographs showing on-site operations, and how chemicals were stored.

Interviews and transcripts of past employees are preempt from disclosure under the Freedom of Information Act, and are not releasable to the general public.

Comment 7: The Commenter states that residential use is not a legitimate future land use and that it is arbitrary to assume basements that do not exist and will not be allowed to be constructed due to the anticipated institutional controls on future development at the site. The Commenter states that the site does not pose a risk to surface water.

There is no risk of the groundwater from the CRS Site causing the surface water to exceed health-based standards;

The CRS Site does not pose a significant risk to human health even for on-site workers;

The site does not pose a significant risk to human health even for on-site workers

EPA's Response 7: Residential use is not a reasonably anticipated future land use at the site. Institutional controls, in the form of restrictive covenants or other appropriate controls to prohibit any land use other than industrial/commercial will be placed on the CRS property.

The site August 2006, Revision 3, Remedial Investigation, conducted by the CRS Site Group, identified unacceptable risks posed by the site under the reasonably anticipated industrial/commercial use scenario. On-site soils pose an unacceptable risk to an outdoor industrial worker via soil ingestion, inhalation and dermal contact exposure pathways (Hazard Index - 8.0). Soils and groundwater pose an unacceptable risk to an indoor industrial worker via vapor inhalation (Hazard Index 357, cancer risk – 2.7×10^{-2}). This risk is above the 10^{-3}, identifying these soils as principal threat wastes. (See Response to Comment 9). Building structures on-site is not a prohibition of the planned institutional controls, and a reasonably anticipated future land use.

The site does not currently pose a threat to nearby surface water bodies. Risk to surface water from site contamination was not a consideration in remedy selection.

Comment 8: The Commenter questions their liability for CRS Site remediation. They claim that those who did not own or operate the solvent recovery operations are not responsible for the questionable housekeeping practices that may have contributed to the release of solvents on the ground at the CRS Site.

EPA's Response 8:

Under CERCLA, four classes of parties, termed "potential responsible parties," may be liable for contamination at Superfund Sites:

- The current owner or operator of the site (CERCLA Section 107(a) (1));
- The owner or operator of a site at the time that disposal of a hazardous substance occurred (CERCLA Section 107(a) (2));
- A person who arranged for the disposal of a hazardous substance at a site (CERCLA Section 107(a) (3)), known as a "generator"; and
- A person who transported a hazardous substance to a site that transporter must have also selected that site for the disposal of the hazardous substances (CERCLA Section 107(a) (4)), 42 U.S.C. Section 9607 (a) or other federal common law, known as a "transporter".

CERCLA Section 107(a) imposes strict liability on the four classes of parties listed above. This means that the PRPs are liable for contamination at the site even if:

- The problems caused by the hazardous substance release were unforeseeable;
- The PRPs actions were legal at the time they occurred; and
- State-of-the-art waste management practices were used at the time the materials were disposed of.

In addition, CERCLA liability is usually joint and several. This means that any one PRP can be held liable for the entire cost of the site cleanup, regardless of the share of the waste contributed by that PRP.

Given these provisions of the Superfund law, all PRPs (current owners and operators, past owners and operators, generators, and transporters) may be liable for cleanup of a Superfund site, even if they did not operate the site and were not a part of the questionable housekeeping practices that may have contributed to the release of solvents on the ground at the site

Moreover, the Agency continues to search for and identify parties responsible for the contamination at the CRS Site.

Comment 9: The Commenter alleges that principal threat wastes are not currently present on the CRS site, and that all principal threat wastes were previously removed from the site in 1983. Because principal threat wastes were alleged removed in 1983, Monitored Natural Attenuation is a justified as the appropriate groundwater remedy at the site, without excavating additional soil.

Specific comments include:
Source removal to address "principal threat wastes" at the site occurred in 1983 when CRS, Inc. removed all visible contaminated soil from the CRS Site. … When additional data were collected during the RI in 2003 at the CRS Site, MNA was justified as the appropriate groundwater remedy without excavating additional soil because the principal threat waste has already been removed (page 5 of the CRS Group Comments on the Proposed Plan).

In 1981-83, U.S. EPA directed CRS, Inc. to excavate soil in the NW corner and the Agency decided when enough soil had been removed to address the principal threat. The soil that remained was not a principal threat waste in 1983 and it is not a principal threat waste today (page 6 of the CRS Group Comments on the Proposed Plan).

The theoretical possibility that these soils "may become a source for additional groundwater contamination" is not sufficient to render these soils a "principal threat". US.EPA relies primarily on the risk to an indoor industrial worker who apparently works in a non-existent basement with poor ventilation that is infiltrated by soil vapors at high concentrations. This is not a principal threat until an indoor area is constructed. It is arbitrary to assume basements that do not exist, and will not be allowed to be constructed due to anticipated institutional controls on future development at the site, when evaluating whether soil exposures will occur (page 6 of the CRS Group Comments on the Proposed Plan).

The data do not support EPA's rationale for removing the soil in the NW corner; i.e., that it will shorten the time needed for natural attenuation to achieve the remedial objectives for groundwater at the CRS Site. Sump removal is the only additional source control necessary to support groundwater restoration and likely to expedite obtaining long-term remedial objectives for groundwater use. (page 7 of the CRS Group Comments on the Proposed Plan).

EPA's Response 9: The scope of action taken by Chemical Recovery Systems, Inc. in 1983 was to excavate and off-site dispose all visibility contaminated soils identified by a joint EPA/CRS visible inspection of the CRS Site under the provisions of the 1983 Consent Decree. No data were collected under this action to identify the remaining concentration of contamination in the soil and no agreement was made in the Consent Decree regarding the level of cleanup or risk reduction that was achieved as a result of this action. The EPA was and is concerned about CRS Site contamination that remains after this 1983 action. As a result of our concern we successfully negotiated a May 29, 2002, Administrative Order on Consent with other CRS site Potentially Responsible Parties (CRS Site Group) to conduct an investigation of site contamination (Remedial Investigation) and conduct an analysis of remedial actions to prevent or mitigate the release or threatened release of hazardous substances, pollutants, or contaminants from the Site (Feasibility Study). It is inaccurate to represent that the principal threat wastes at the CRS site were already fully addressed by the 1983 action.

The soils contaminated with high concentration of solvents found in the NW corner of the CRS site today are considered principal threat waste, consistent with the NCP and EPA guidance. The National Contingency Plan identifies as principal threat wastes: liquids, areas contaminated with high concentrations of toxic compounds, and highly mobile materials. EPA further defines principal threat wastes in OSWER Publication 9380.3-06FS, *A Guide to Principal Threat and Low Level Threat Wastes*, November 1991, to be those source materials (including contaminated soil)

considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. The guidance notes that no "threshold level" of toxicity/risk has been established to equate to "principal threat"; however, where toxicity and mobility of sources material combine to pose a potential risk of 10^{-3}, treatment alternatives should be evaluated.

The soils in the NW corner of the CRS site are contaminated with high concentrations of mobile hazardous substance solvents, supporting identification of these contaminated soils as principal threat wastes. Groundwater underneath the site is contaminated with the solvents in the soil, indicating that these soils are serving as a source to the groundwater contamination. Results from the Groundwater Leaching Model conducted by the CRS Site Group in the August 2006 Feasibility Study (Appendix C) show that predicted groundwater concentration of PCE leaching from the contaminated soil in the NW corner of the site will be 73,200 µg/liter (five order of magnitude above the MCL) and predicted groundwater concentration of TCE leaching from the contaminated soil in the NW corner of the site will be 76,100 µg/liter (five orders of magnitude above the MCL). Predicted groundwater concentrations of other hazardous substances from this contaminated soil can be found in Appendix C of the FS.

An assessment of the risk that these contaminated soils pose under a reasonable future commercial/industrial land use scenario for exposure to indoor air are 2.7×10^{-2}; this is above the potential risk of 10^{-3} supporting identifying of these soils as principal threat wastes.

The EPA evaluated treatment options for these principal threat wastes; however, none were identified as feasible for these soils. However, the relatively small volume of this principal threat waste support the selection of off-site disposal as the remediation for these soils instead of on-site containment which may allow continued leaching of the contaminants from the soil to the groundwater.

The Commenter's position that the Monitored Natural Attenuation (without excavating additional soil) remedy is justified because there is no principal threat waste at the site is thus faulty. In fact it is the presence of these principal threat contaminated soils, coupled with the selected MNA remedy for the groundwater, which provides additional justification for the off-site disposal of these soils. OSWER Directive 9200.4-17P, *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites, April 21, 1999,* notes that source control and long term performance monitoring are expected to be fundamental components of any MNA remedy and that MNA should only be selected where it will meet site remediation objectives within a timeframe that is reasonable compared to that offered by other methods. The off-site disposal of the highly contaminated soils is a considerably more reliable source control measure than on-site containment and eliminates these soils as a source of continuing site groundwater contamination. Given the current extent of groundwater contamination at CRS, MNA is expected to reach groundwater cleanup goals (drinking water standards) in a reasonable timeframe. However, if these highly contaminated soils remain on-site, the potential exists for contaminants to leach from these soils and significantly increase groundwater contaminant concentrations, and thus defeat the ability of the MNA processes at CRS to reach groundwater cleanup goals in a reasonable timeframe.

Comment 10: The Commenter questions the protectiveness (short-term and long-term) of the Selected Remedy.

Specific comments include:

Long-term risk associated with the excavation alternative is greater that the long-term risk associated with any of the alternatives involving an infiltration barrier;

A solid waste landfill receiving this non-hazardous soil will not provide greater long-term protection from residual COCs than the proposed infiltration barrier over soil remaining on-site;

The infiltration barrier remedies offer greater long-term effectiveness than partial excavation, which merely moves the COCs to another location;

The more expensive remedy actually increases short-term and long-term risk;

Soil excavation itself increases short-term risk to workers and area residents by exposing volatile organic compounds to the air where they may volatilize or travel on dust particles and become available to receptors through inhalation, ingestion, or dermal adsorption pathways.

EPA's Response 10:

Contaminated soil will be more effectively managed if sent off-site for disposal than if left on-site and covered with an impermeable membrane and soil cover. Depending on the nature of the contamination in the soil planned for excavation, it will be sent to a licensed hazardous waste landfill or licensed solid waste landfill.

The design requirements for a licensed hazardous waste landfill are found in 40 C.F.R. Part 264 (Subtitle C of RCRA), and require a double liner, double leachate collection and removal system, a leak detection system, run-on, run-off and wind dispersal controls, and construction quality assurance. Upon closure of the hazardous waste landfill, a state-of-the-art impermeable landfill cover and groundwater monitoring are some of the important components of the closure and post-closure care requirements.

Contaminated soil sent to a licensed solid waste landfill will need to comply with the design requirements found in 40 CFR Part 258 (Subtitle D of RCRA), These design requirements include a geomembrane/compacted clay soil liner, a leachate collection and removal system, operating practices that require compacting and covering the waste, and groundwater monitoring. Upon closure of the solid waste landfill, a landfill cover and long-term care will be required. Subtitle C and D both include corrective action provisions to address any releases from waste management units, and financial assurance provision that provide for environmental protection during and after landfill closure.

Contaminated soil left on the CRS site would be managed in an unlined area of contaminated soil, without a leachate collection system and without other protective provisions of RCRA managed units, making it a significantly less protective approach for long term management of these contaminated soils.

The minimal short term risk to on-site workers and the surrounding population during excavation and off-site disposal of the highly contaminated soils will be monitored during construction activities, and alleviated if necessary.

Comment 11: Commenter alleges that EPA did not follow established guidelines of the CERCLA Process.

Specific comments include:

The process EPA undertook in this instance directly contravenes established guidelines and the appropriate procedural methods that are ingrained in the CERCLA remediation process. The Agency disregarded the results of the deliberative RI/FS process and chose an undeveloped, over extensive remedial alternative at the last minute.

EPA reviewed and approved interim RI/FS documents without suggesting that we need to characterize the NW corner of the site for excavation. EPA first requested an evaluation of a partial excavation remedy on November 9, 2006, two months after we had received confirmation from the Agency that the RI/FS was complete.

EPA gave us every indication that a containment remedy would be the proposed remedy for the site.

EPA Response 11:

EPA identified a preferred remedial action at the site, based on all of the information in the site Administrative Record (AR), consistent with Section 300.800 of the NCP. Information in the AR includes but is not limited to the August 2006, Revision 3, RI/FS performed by the CRS Site Group.

The preferred remedy for the site was identified in the Proposed Plan, consistent with Section 300.430(f) of the NCP. The Proposed Plan was issued for public comment on July 9, 2007. The selected remedy is consistent with the preferred remedial action identified in the Proposed Plan.

Comment 12: Commenter questions the mobility of the contaminants in the soil to the groundwater.

Specific comments include:

If COCs were going to leach from the soil into groundwater, it would have occurred long ago.

We know that the soil in the NW corner is not highly mobile because it has stayed in the soil for over 24 years in stubborn resistance to natural forces.

EPA's Response 12: Groundwater underneath the site is contaminated with the same solvents in the soil, indicating that these soils are serving as a source to the groundwater contamination. Results from the Groundwater Leaching Model conducted the CRS Site Group in the August 2006 Feasibility Study (Appendix C) show that predicted groundwater concentration of PCE leaching

from the contaminated soil in the NW corner of the site will be 73,200 µg/liter (five orders of magnitude above the MCL) and predicted groundwater concentration of TCE leaching from the contaminated soil in the NW corner of the site will be 76,100 µg/liter (five orders of magnitude above the MCL). Predicted groundwater concentrations of other hazardous substances from this contaminated soil can be found in Appendix C of the FS.

Comment 13: The Commenter suggests that EPA concerns that the infiltration barrier is not sufficiently permanent are misplaced.

Specific comment includes:

To seriously question the permanence of infiltration barriers would unnecessarily call into question approved remedies at sites throughout the country.

EPA's Response 13:
EPA's concern about onsite management of the highly contaminated soils in the NW corner of the site is not limited to the fact that an infiltration barrier would not be sufficiently permanent. Remedy selection decisions are site specific. On-site containment is preferred for low-level contamination. We believe that the off-site disposal option for these highly contaminated principal threat wastes is a superior approach for managing these wastes. (See response to Comments 9 and 10).

Additionally, we do not believe that this infiltration barrier, coupled with the Monitored Natural Attenuation (MNA) groundwater remedy, will provide sufficient contamination source control management to allow the MNA groundwater remedy to achieve cleanup goals in a reasonable amount of time. (See also Response to Comment 9.)

Comment 14: The Commenter had questions regarding the selected remedy costs.

Specific comments include:

Despite the erroneous reference to 14,400 cubic yards on page 14 of the Proposed Plan, EPA's cost estimate is based on 3,500 cubic yards of excavated soil (0.5-acres excavated to 4 foot depth). The total present worth of the partial excavation remedy is expected to cost $2.88 million;

When evaluating the true cost burden to fund this project, many additional cost were not considered; such as EPA oversight cost, EPA contractor costs, EPA past costs, the cost of the RI/FS;

The CRS group objects to the use of contractors by EPA to conduct oversight of PRP work because it adds an additional layer of oversight. The oversight costs at this site, $464,182.70, have been unusually excessive.

EPA fails to demonstrate how in increased cost associated with partial excavation will provide better overall risk reduction or protection of human health and the environment.

EPA' Response 14:

There was a typographical error in the Proposed Plan, reporting 14,400 cubic yards of contaminated soil would be excavated, on page 14. The error was noted during the Proposed Plan presentation, and correct information provided. Our best estimate is that 3,500 cubic yards of highly contaminated soil will be removed from the NW portion of the site under the selected remedial alternative. The exact amount of soil to be excavated will not be determined until the excavation actually occurs. This information will be reported in the Post-Construction Completion Report for the CRS Site after the remedy is implemented.

The current total present worth cost estimate for the selected remedy is $2.1 million. Cost estimates were adjusted upward ($179,388) for all alternatives, except for the No Action Alternative. The increased adjustments included the costs for the pre-design study and the placement of additional monitoring wells. Additionally, also to Alternative 6, upward adjustments were made to include the soil density disposal costs omitted in the Proposed Plan. This cost estimate is considered to be more accurate, and within the range of +50%/-30%, as typical of Superfund program remedial action cost estimates.

The oversight costs incurred to date are associated with the RI/FS conducted by the CRS Site Group under the Administrative Order (AOC) on Consent, May 29, 2002. In the AOC the CRS Site Group agreed to pay oversight costs, consistent with Section 104 (a) (1) of CERCLA. EPA did consider cost savings during RI/FS oversight management at the Site by doing the following:

- The Agency eliminated the standard split sampling of samples collected at the site;
- The Agency provided the commenter with work planning documents instruction, such as the specific information to get Quality Assurance Project Plan approved without going through several iterations;
- The Agency made sure that only one person was on-site to provide oversight of the field activities; and
- The Agency utilized several conference calls instead of face to face visit to discuss risk assessment revisions, therefore eliminating the additional travel expense.

These and other past costs at the site have no bearing on the future cost of the remedial action at the site, and were not considered by the EPA when selecting the CRS final remedial action.

Remedial action cost estimates do not include necessary costs associated with EPA oversight when a Potentially Responsible Party conducts the remedial design and remedial action. EPA oversight of PRP remedial design and remedial action is necessary in order for the Agency to ensure that response actions conducted by PRPs is done properly and promptly as required in CERCLA 104(a)(1). These oversight costs are not incurred when the remedy is funded by EPA.

The additional cost of off-site disposal of the highly contaminated soils in the NW corner of the site is considered proportionate to the additional environmental protection achieved by this more effective remedy when compared with the containment remedies evaluated. (See Responses to Comments 9 and 10.)

END OF THE RESPONSIVENESS SUMMARY

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